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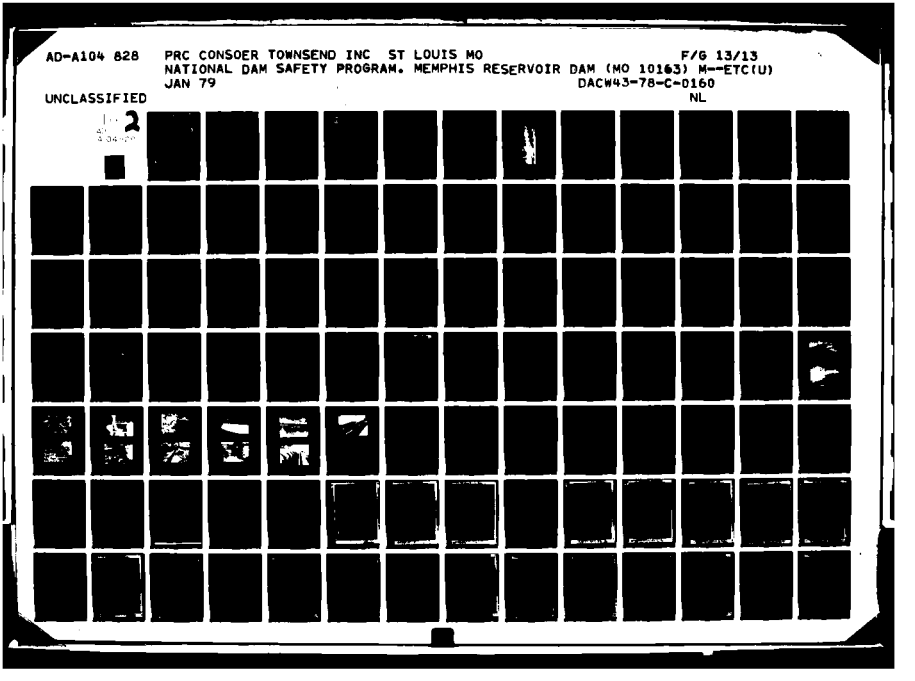

LEVEL II

MISSISSIPPI - SALT - QUINCY RIVER BASIN

AD A104828

MEMPHIS RESERVOIR DAM

SCOTLAND COUNTY, MISSOURI

MO 10163

PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

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JANUARY 1979

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Memphis Reservoir Dam (Mo. 10163),
Phase I Inspection Report

This report presents the results of field inspection and evaluation of Memphis Reservoir Dam (Mo. 10372). It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED
Chief, Engineering Division

1 MAR 1979
(Date)

APPROVED BY: SIGNED
Colonel, CE, District Engineer

1 MAR 1979
(Date)

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Memphis Reservoir Dam, Missouri Inv. No. 10163
State Located:	Missouri
County Located:	Scotland
Stream:	Unnamed Tributary of the North Fabius River
Date of Inspection:	October 4, 1978

Memphis Reservoir Dam No. Mo.10163 was inspected using the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of Federal and state agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. Three houses, the Scotland County Fairgrounds, several farm buildings, and a State Highway crossing would be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Memphis Reservoir Dam is in the small size classification since it is less than 40 feet high and impounds less than 1,000 acre-feet of water.

Our inspection and evaluation indicates that the spillway of Memphis Reservoir Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Memphis Reservoir Dam is a small size dam with a high hazard potential required by the guidelines to pass the Probable Maximum Flood without overtopping. Since there is a significant development downstream of the dam, the Probable Maximum flood is the appropriate spillway design flood. It was determined that the spillway will pass 25 percent of the Probable Maximum Flood without overtopping the dam. Also, our evaluation indicates that the spillway will pass the 100-year flood; that is, a flood having a 1 percent chance of being equalled or exceeded during any given year.

The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

Other deficiencies noted by the inspection team were a need for an periodic inspection by a qualified professional engineer; the lack of a maintenance schedule; small trees and brush on the upstream embankment slope; vegetation in the approach channel of the spillway; and eroded and spalled concrete on the spillway structure. The lack of stability and seepage analysis on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct or control the deficiencies described above.

MEMPHIS RESERVOIR DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Memphis Reservoir Dam, I.D. No. 10163

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MEMPHIS RESERVOIR DAM, Missouri Inv. No. 10163

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for the Memphis Reservoir Dam was carried out under Contract DACW 43-78-C-0160 to the Department of the Army, St. Louis District, Corps of Engineers, by the engineering firms of Consoer, Townsend & Associates Ltd., and Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of the Memphis Reservoir Dam was made on September 28, and October 4, 1978. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

It should be noted that reference in this report to left or right abutments is as viewed looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to north abutment or side, and right to the south abutment or side.

d. Evaluation Criteria

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams", Appendix D. These guidelines were developed with the help of several Federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The dam embankment is a homogeneous earthfill structure. The crest of the embankment has a width of 20 feet and a length of approximately 854 feet. The crest has a minimum elevation of 720.2 feet above MSL, and the maximum height of the embankment is 28.2 feet above the minimum streambed elevation along the centerline of the dam.

The upstream slope of the embankment section is constructed with a 1V to 2H slope, and the downstream embankment slope is 1V to 1-3/4H. A thin layer of rock riprap is provided on the upstream slope from the crest to approximately elevation 715.0. The riprap is composed of angular blocks of limestone up to 2 feet in diameter with the majority of the blocks 6 inches to 1 foot in diameter. The crest and downstream embankment slopes are protected with a vegetative cover.

Bedrock at the site and within the vicinity is composed of Pennsylvanian age limestone and minor amounts of sandstones and shales. No bedrock crops out over the site, but the rolling hills are mantled with a residual clay, a weathered product of the bedrock. The site is adjacent to the floodplain of the North Fabius River, thus, alluvial deposits of unknown thickness are expected in the relatively broad valley at this site.

The abutments and spillways for the dam are founded in the residual clays. The embankment across the valley has been placed upon alluvial sediments.

Available design drawings do not indicate the type of foundation treatment undertaken prior to fill placement.

There are three spillways for the Memphis Reservoir. The service spillway, which is the oldest among the three spillways, is located on the right abutment of the embankment. This spillway consists of an uncontrolled concrete weir section, a spillway chute, a stilling basin with baffle blocks, and an exit channel. Spillway No. 2, which was also part of the original construction, is connected to the right entrance wall of the service spillway crest structure. This spillway was rebuilt in 1958, due to severe concrete cracking and failure of the original spillway crest. The present spillway crest is a new concrete wall containing seven weir openings. The spillway chute and exit channel remain the same as the original construction.

The emergency spillway is located at approximately 300 feet south of the dam embankment at the southeast corner of the reservoir. The emergency spillway is a grass lined open channel which runs easterly for about 150 feet, then turns north into the natural channel.

Structural dimensions of these spillway are given in Section 1.3, Appendix D, and in the plates in this report.

Up to the time of this report, design data with an adequate description of the submerged and underground features of the outlet works and pumping plant was not available. The description herein, therefore, is derived wholly from the visual inspection observations.

An intake tower approximately 4 feet square and constructed of concrete is situated in the reservoir about 40 feet upstream of the dam crest. Access to the tower is provided by two parallel steel I-beams, spanning from the dam crest to the tower, to which a walkway of wood planks is bolted.

A pump vault lies at the downstream toe of the dam opposite the intake tower. The vault contains two horizontally mounted centrifugal pumps with 4-inch discharge pipes connected in parallel to a 6-inch discharge line. The pump suctions connect to a 6-inch pipe which, presumably, passes under the dam embankment to connect to the intake tower.

The water surface elevation was about 1 inch below the service spillway crest at the time of inspection.

The reservoir rim is generally gentle sloping, with a city park area at the left shore and trees, grass and brush at the right shore.

b. Location

The Memphis Reservoir Dam is located on an unnamed tributary of the North Fabius River, Scotland County, Missouri. The reservoir is also located just downstream from the Memphis Lake and Park Dam, which was built in 1974. The nearest downstream community is Memphis, Missouri, which is roughly 2 miles from the dam. The dam and reservoir are shown on the Memphis Quadrangle Sheet (7.5 minute series) in Section 14, Township 65 North, Range 12 West.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams", by the U.S. Department of the Army, Office of the Chief Engineer, the dam is classified in the dam height category as being "Small" since its storage is less than 1,000 acre-feet. The dam is also classified as "Small" in dam size category because its height is less than 40 feet. The overall size classification is, accordingly, "Small" in size.

d. Hazard Classification

The dam has been classified as having "High" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. Our findings concur with the classification. The estimated damage zone extends two miles downstream of the dam. Within the damage zone are two to three houses, the Scotland County Fairgrounds, several farm buildings, and a State highway crossing. The floodplain is farmed.

e. Ownership

Memphis Reservoir Dam is owned by the City of Memphis, Missouri.

f. Purpose of Dam

The main purpose of the dam is to impound water for use as water supply for the City of Memphis, Missouri.

g. Design and Construction History

Memphis Reservoir Dam was constructed in 1931. In 1958, the new concrete spillway wall with the series of weir openings was constructed. This reconstruction was designed by Frank Beard, P.E., of Kahoka, Missouri. Raising of the dam was planned and designed in 1958, but the work was never done.

h. Normal Operational Procedures

The dam is used to impound water for recreational use and water supply. The water level is controlled by rainfall, runoff, evaporation, and discharges from the Memphis Lake and Park Dam (10217), which is located approximately one-half mile upstream. It is believed that the reservoir is kept as full as possible at all times.

1.3 Pertinent Data

Memphis Reservoir Dam

a.	Drainage Area (acres):	947 (Excluding drainage area of Memphis Lake & Park Dam)

b. Discharge at Damsite

Estimated experienced maximum flood (cfs):	700
Estimated ungated spillway capacity at maximum pool elevation (cfs):	3,751

c. Elevation (Feet above MSL)

Top of dam:	720.2
Spillway crest:	
Spillway No. 1	716.2
Spillway No. 2	717.1
Emergency Spillway	717.7
Minimum streambed elevation at centerline of dam:	701.0
Maximum tailwater:	Unknown

d. Reservoir

Length of maximum pool (feet):	5,600

e. Storage (Acre-Feet)

Top of dam:	235

f. Reservoir Surface (Acres)

Top of dam:	54
Spillway crest:	41

g. Dam

Type:	Earth embankment
Length:	854 feet
Height (maximum):	28.2 feet
Top width:	20 feet
Side slopes:	
Downstream	1V to 1-3/4H
Upstream	1V to 2H
Zoning:	None

Impervious core:	None
Cutoff:	Not known
Grout curtain:	None

h. Diversion and Regulating Tunnel — None

i. Spillway

Type:	Uncontrolled
Length of weir (feet):	
Spillway No. 1	58
Spillway No. 2	57.19 feet
Emergency Spillway	75
Crest Elevation (feet above MSL):	
Spillway No. 1	716.2
Spillway No. 2	717.1
Emergency Spillway	717.7

j. Regulating Outlets

Type:	6-inch cast iron pipe
Length:	80 feet
Closure:	Gate valve at pump vault
Maximum Capacity:	Unknown

Memphis Lake and Park Dam

a. Drainge Area: 1,950 acres

b. Discharge at Damsite: All discharge at the damsite is through two uncontrolled spillways with an 18-inch cast iron gate in the service spillway shaft, a low level outlet conduit, and a water supply system

Estimated experienced maximum flood:	0 cfs
Estimated ungated spillway capacity at maximum pool elevation:	7,565 cfs

c. Elevation: (Feet above MSL)

Top of dam:	780.0
Spillway crest: (Service spillway)	770.0
(Emergency spillway)	774.0
Minimum streambed elevation at centerline of dam:	710.0
Maximum tailwater:	Unknown

d. Reservoir

Length of maximum pool:	8,600 feet ±

e. Storage: (Acre-Feet)

Top of dam (from 1974 inventory):	7,030
Spillway crest: (Service spillway)	5,164
(Emergency spillway)	4,109

f. Reservoir Surface: (Acres)

Top of dam (interpolated value):	342
Spillway crest:	248

g. Dam

Type:	Zoned earth embankment
Length:	1,635 feet
Height (maximum):	70 feet
Top width:	10 feet
Side slopes:	
(Downstream)	1V to 2-1/2H for top 20 feet 1V to 4H for next 16 feet 1V to 10H for next 4 feet 1V to 2-1/2H to ground surface
(Upstream)	Same

Zoning:	Three - core, shells and stabilization berms
Impervious core:	5-foot top width with 1V to 1H upstream slope and 3/4V to 1H downstream slope
Cutoff:	Core trench with 10-foot bottom width and 1V to 1H side slopes
Grout curtain:	None

h. Diversion Tunnel — None

i. Spillway

Type:	(Service spillway)	Uncontrolled
	(Emergency spillway)	Uncontrolled
Length of weir:	(Service spillway)	25 feet
	(Emergency spillway)	250 feet
Crest elevation:	(Service spillway)	770 feet
	(Emergency spillway)	774 feet

j. Regulating Outlets

Type:	18-inch sluice gate discharging into service spillway conduit
Length:	350 feet
Closure:	18-inch sluice gate
Maximum capacity:	30 cfs

Type:	12-inch diameter ductile iron low level outlet pipe
Length:	420 feet
Closure:	Mud valve at upstream end and gate valve at downstream end
Maximum capacity:	$\pm$ 25 cfs

Type:	12-inch diameter ductile iron water supply outlet
Length:	Unknown

Closure:	Gate valve at upstream end
Maximum capacity:	Unknown

SECTION 2: ENGINEERING DATA

2.1 Design

The available design drawings are very incomplete. No drawings of the original construction were found, and the only drawings located were of proposed reconstruction in 1958, most of which was not constructed. These drawings partially show the existing structures at that time.

2.2 Construction

The dam was originally constructed in 1931. In 1958, a new spillway wall for spillway No. 2 was constructed upstream of the existing wall which ran in a north-south direction.

2.3 Operation

No operation records for Memphis Reservoir Dam are available.

2.4 Evaluation

a. Availability

The only engineering data available are drawings made in 1958 showing proposed reconstruction, most of which was not constructed. These drawings partially show the existing dam at that time. No design computations, construction data, or operation data is available.

In addition, no pertinent data was available for review of hydrology spillway capacity, flood routing through the reservoir, outlet capacity, slope stability, seepage analysis, or foundation conditions.

b. Adequacy

The engineering data available is inadequate to aid in evaluating the hydraulic and hydrologic capabilities and stability of the dam for Phase I investigations.

The lack of engineering data did not allow for a definitive review and evaluation. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing and evaluating design, operation and construction data, but is based primarily on visual inspection, past performance history, and sound engineering judgment.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity

No valid engineering data is available.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of Memphis Reservoir Dam was made on September 28, and October 4, 1978. The following persons were present during the inspection:

Name	Affiliation	Disciplines
Yin Au-Yeung	Engineering Consultants, Inc.	Project Engineer, Hydraulics and Hydrology
David Bramwell	Engineering Consultants, Inc.	Geology
Jon Diebel	Engineering Consultants, Inc.	Soils
John Ismert	Engineering Consultants, Inc.	Mechanical
Kevin Blume	Consoer, Townsend & Assoc., Ltd.	Civil & Structural

Specific observations are discussed below.

b. Dam

The crest of the dam is adequately protected by vegetative cover. The crest makes a nearly 90 degree bend to the west at the left side of the dam.

The upstream embankment slope is protected with a 1 to 2 foot thick layer of dumped riprap. The riprap is composed of angular blocks of limestone up to 2 feet thick, with most of the blocks having a size between 6 inches and 1 foot. The riprap extends from a point several feet from the

top of the crest on below elevation 716.2 for an unknown depth. Some large brush and small trees are beginning to grow on the upstream slope of the embankment, but not to an extensive degree at this time. Sloughing and erosion was not prevalent on the slope at this time.

The downstream embankment slope is protected by a vegetative cover. The vegetation had been recently cleared prior to the inspection. Some stumps of trees which had been previously cut were observed. No signs of past or present instability were seen on the embankment or in the foundation at any location. Also, no seepage was observed on the downstream embankment slope or downstream of the toe of the dam.

c. Appurtenant Structures

(1) Spillway

Mostly due to the old age of the structure, the service spillway shows signs of deterioration. Some leakage is occurring through the vertical concrete weir. In addition, vertical and horizontal cracking, and concrete spalling and erosion was observed throughout the concrete channel. Dense grasses are growing in the spillway approach areas.

Spillway No. 2, which is relatively new, is in adequate condition. Only minor cracks in the weir structure were observed.

The emergency spillway is well-defined and adequately protected by thick grass.

All three spillways merge into the natural channel approximately 70 feet downstream of the embankment toe.

(2) Outlet Works

Inspection was made of the unsubmerged portion of the intake tower. The concrete which could be observed was old, but in satisfactory condition. The top of the tower is covered by a steel sheet cover which could not be removed. A heavy wire screen mounted to a crude wooden frame was suspended over the face of one side of the tower; presumably this is a trash screen over the intake opening.

The cover of the pump vault was removed and the vault was entered for inspection. The appearance of the pumping and piping equipment was satisfactory, except there was several inches of standing water over the vault floor, and the electrical control boxes were open and the exposed wiring was in disarray. It was obvious from the condition of the wiring that the pumps were not operational.

d. Reservoir Area

No wave wash, excessive erosion, or slope slides were observed along the shore of the reservoir. At present, no development has occurred along the shoreline. In general, the reservoir rim is stable. Most of the inflow into the reservoir is controlled by releases from the Memphis Lake and Park Dam, which is located about one-half mile upstream from Memphis Reservoir.

e. Downstream Channel

Spillway discharge from all the spillways merge into the natural channel at approximately 70 feet downstream of the embankment toe. The downstream channel is an unlined trapezoidal channel which was sparsely covered with fallen tree trunks and debris at the time of inspection. However, this minor obstruction in the channel does not seem to pose serious restrictions to the spillway capacity. Signs of moderate erosion and sloughing on the right bank of the channel were observed.

3.2 Evaluation

The visual inspection did not exhibit any items which are sufficiently significant to indicate a need for immediate remedial action.

The following deficiencies were observed which could affect the safety of the dam, or which will require maintenance within a reasonable period of time.

1. The trees and brush beginning to grow on the upstream embankment slope.

2. The vegetation growing in the approach channel for the service spillway and the slotted spillway.

3. The deteriorated concrete and leakage observed in the concrete channel of the service spillway.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Normal procedure is to allow the reservoir to stay close to full at all times. Should the water level drop below acceptable levels, water is released from the Memphis Lake and Park Dam (MO 10217), and allowed to flow along the natural streambed to the reservoir downstream. Basically, the water level is controlled by rainfall, runoff, evaporation, and water consumption of the city of Memphis, Missouri.

4.2 Maintenance of Dam

Maintenance is performed at the damsite by workers employed by the city of Memphis, Missouri. At the time of inspection, it was apparent that all trees and brush had been recently cleared from the downstream embankment slope. Small trees are growing on the upstream slope, and should also be removed. Observation of the small pump vault located at the downstream toe, opposite the intake tower, showed the pumps to be inoperable. The inspection team was not aware of any available maintenance or water level records.

4.3 Maintenance of Operating Facilities

The only operating facility at the damsite is the small water supply pump vault located at the downstream toe opposite the 3-foot square concrete intake tower. The small vault contains two horizontally mounted centrifugal pumps with 4-inch discharge pipes

connected in parallel to a 6-inch discharge line. The appearance of the pumping and piping equipment in the vault was satisfactory, except there was several inches of standing water over the vault floor and the electrical control boxes were open, with the exposed wiring in disarray. It was obvious from the condition of the wiring that the pumps were not operational, due to a lack of maintenance.

4.4 Description of Any Existing Warning System

The inspection team is not aware of any existing warning system in effect.

4.5 Evaluation

The maintenance and operation at the damsite is fair. The clearing of the upstream slope should be done within a reasonable period of time, and the access to the pump vault should be made secure and kept locked for public safety. Other items requiring maintenance are discussed in Section 3.2.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

No hydrologic design data is available.

The watershed area of Memphis Reservoir is roughly 2,899 acres, which includes the New Memphis Lake and its watershed area of ± 1,950 acres. This area is approximately 5 percent covered with brush and forest. Land gradients average about 4 percent. The Memphis Reservoir is located just downstream of the New Memphis Lake, on an unnamed tributary of the North Fabius River. The Memphis Lake and Park Dam is located approximately one-half mile upstream from the Memphis Reservoir.

Elevations within the watershed range from approximatly 700 feet above MSL at the damsite to over 815 feet above MSL in the upper portion of the watershed.

A drainage map showing the watershed area is included in Appendix B.

Evaluation of the hydraulic and hydrologic features of Memphis Reservoir Dam was based on criteria set forth the the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, and additional guidance provided by the St. Louis District of the Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation (PMP) using the methods outlined in the

U.S. Weather Bureau Publication, Hydrometeoroglogical Report No. 33. The probable maximum storm duration was set at 24 hours, and storm rainfall distribution was based on criteria given in EM 1110-2-1411 (Standard Project Storm). The SCS triangular hydrograph, transformed to a curvilinear hydrograph, was adopted for developing the unit hydrograph for drainage area between the upstream dam and the Memphis Reservoir. The derived unit hydrograph is presented in Appendix B.

Initial and infiltration loss rates were applied to the PMP to obtain rainfall excesses. The rainfall excesses were then applied to the unit hydrograph to obtain the PMF hydrograph, utilizing the Corps of Engineers' computer program HEC-1, (Dam Safety Version), which was prepared specifically for dam safety analysis. The computed peak discharge of the PMF and one-half of the PMF for drainage area between the upstream dam and Memphis Reservoir are 10,971 cfs and 5,486 cfs, respectively.

Both the PMF and one-half of the PMF inflow hydrographs for drainage area between the upstream dam and the Memphis Reservoir were added to the routed PMF, and one-half of the PMF from the upstream reservoir. The combined hydrographs were routed through the Memphis Reservoir by the Modified Puls Method, also utilizing the HEC-1 (Dam Safety Version) computer program. The peak outflow discharges for the PMF and one-half of the PMF at the Memphis Reservoir Dam are 15,358 cfs and 4,515 cfs, respectively. Both the PMF and one-half of the PMF, when routed through the reservoir, resulted in overtopping of the dam.

The stage-outflow relation for the spillways were prepared from field notes and sketches. The reservoir stage-capacity data were based on the U.S.G.S. quadrangle topographic maps in combination with data given in the National Dam Safety Inventory Table. Reservoir storage capacity included surcharge levels exceeding the top of the dam, and the spillway overtop rating curve assumed that the dam remains intact during routing. In the routing computations, the discharge through the outlet facilities was excluded due to its insignificant magnitude as compared to the total spillway discharge and the PMF. The spillway rating curves and the reservoir capacity curve are also presented in Appendix B.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site. However, according to interviews with local residents, the maximum reservoir level was never higher than the crest of the embankment.

c. Visual Observations

The service spillway structure is deteriorating. Vertical cracks, moderate erosion and spalling on the concrete were apparent. The right bank of the exit channel shows signs of a moderate degree of erosion and sloughing. There is grass growing in front of the spillway entrance of both the service spillway and the No. 2 spillway.

The emergency spillway is in adequate condition.

All the spillways and the exit channels are located at the furthermost right abutment and are away from the downstream toe of the dam. Releases from the spillways will not endanger the integrity of the dam.

d. Overtopping Potential

As indicated in Section 5.1-a., both the Probable Maximum Flood and one-half of the Probable Maximum Flood, when routed through the reservoir, resulted in overtopping of the dam. The PMF and one-half of the PMF overtopped the dam crest by 3.93 feet and 1.23 feet, respectively. The total duration of embankment overflow is 9.0 hours during the PMF, and 3.83 hours during one-half of the PMF. The spillway of the Memphis Reservoir Dam is capable of passing a flood equal to approximately 25 percent of the PMF just before overtopping the dam. The 25 percent PMF has a frequency occurrence of less than the 1 percent chance flood. Since the PMF is the minimum Spillway Design Flood (SDF) for Memphis Reservoir Dam, according to the Recommended Guidelines for Safety Inspection of Dams by the Corps, the spillway capacity of the dam is considered "Inadequate".

The effect from rupture of the dam could extend approximately 2 miles downstream of the dam. There are two to three farmhouses, the Scotland County Fairgrounds, several farm buildings and one State Highway crossing within this 2 miles of floodplain area. The floodplain is extensively farmed.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no signs of settlement or distress observed on the embankment or foundation during the visual inspection. The upstream slope, crest, and downstream slope are well protected by either riprap or vegetation. Seepage was not observed on the downstream slope or beyond the toe of the embankment. The small trees and brush beginning to grow on the upstream embankment slope should be cleared.

The concrete spillway structures, although old and deteriorating, are in satisfactory structural condition. Some grouting to stop the leakage should be performed, and patching of badly spalled areas should be done as it becomes necessary.

The downstream channel may require remedial work following discharges through the spillway during flood conditions, but no immediate remedial work is required at this time.

No problems were observed with the water supply outlet which would jeopardize the safety of the dam.

b. Design and Construction Data

No design or construction data relating to the structural stability of the dam or appurtenant structures were found.

c. Operating Records

No operating records are available relating to the stability of the dam or appurtenant structures. Water levels have not been recorded, however, the dam was within 1 inch of being full on the day of inspection, and is assumed to be close to full at all times. The only operation facility at the dam is the water supply outlet pipe.

d. Post Construction Changes

No post construction changes exist which will affect the structural stability of the dam. At spillway No. 2, the new spillway wall replaced an old wall which had failed.

e. Seismic Stability

In general, projects located in Seismic Zones 0, 1 and 2 can be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist. Memphis Reservoir Dam is located in Seismic Zone 1. A detailed seismic analysis is not felt to be necessary for this embankment.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that an unsafe condition could be detected.

a. Safety

The spillway capacity at Memphis Reservoir Dam was found to be inadequate. The spillway is capable of passing a flood equal to 25 percent of the PMF.

The general physical condition of the dam and appurtenant structures is fair. The leakage through the service spillway crest should be stopped, and patchwork to the deteriorating concrete should be done as it becomes necessary.

The vegetation should be cleared from the approach channels to the spillway.

The trees starting to grow on the upstream embankment slope should be cut before they become a hazard to the embankment. The downstream embankment slope should be maintained in its present condition.

b. Adequacy of Information

Information concerning operation and maintenance of the dam and appurtenant structures is somewhat lacking. It is recommended that the following programs be initiated to help alleviate this problem:

1. Periodic inspection of the dam by an engineer experienced in design and construction of earth dams.

2. Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

3. The dam should be surveyed and an as-built set of plans and drawings should be completed.

4. Perform seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams".

c. Urgency

The remedial measures recommended in Paragraph 7.2 should be accomplished in the near future.

Increasing the spillway capacity is of a more urgent nature than the other recommended actions.

d. Necessity for Phase II Inspection

Based on results of the Phase I inspection, and if the remedial measures recommended in Paragraph 7.2 are undertaken as soon as possible, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. The spillway size and/or height of the dam should be increased to pass the Probable Maximum Flood.

b. O & M Maintenance Procedures

1. Periodic inspection of the dam by an engineer experienced in design and construction of earth dams.

2. Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

3. The dam should be surveyed and an as-built set of plans and drawings should be completed.

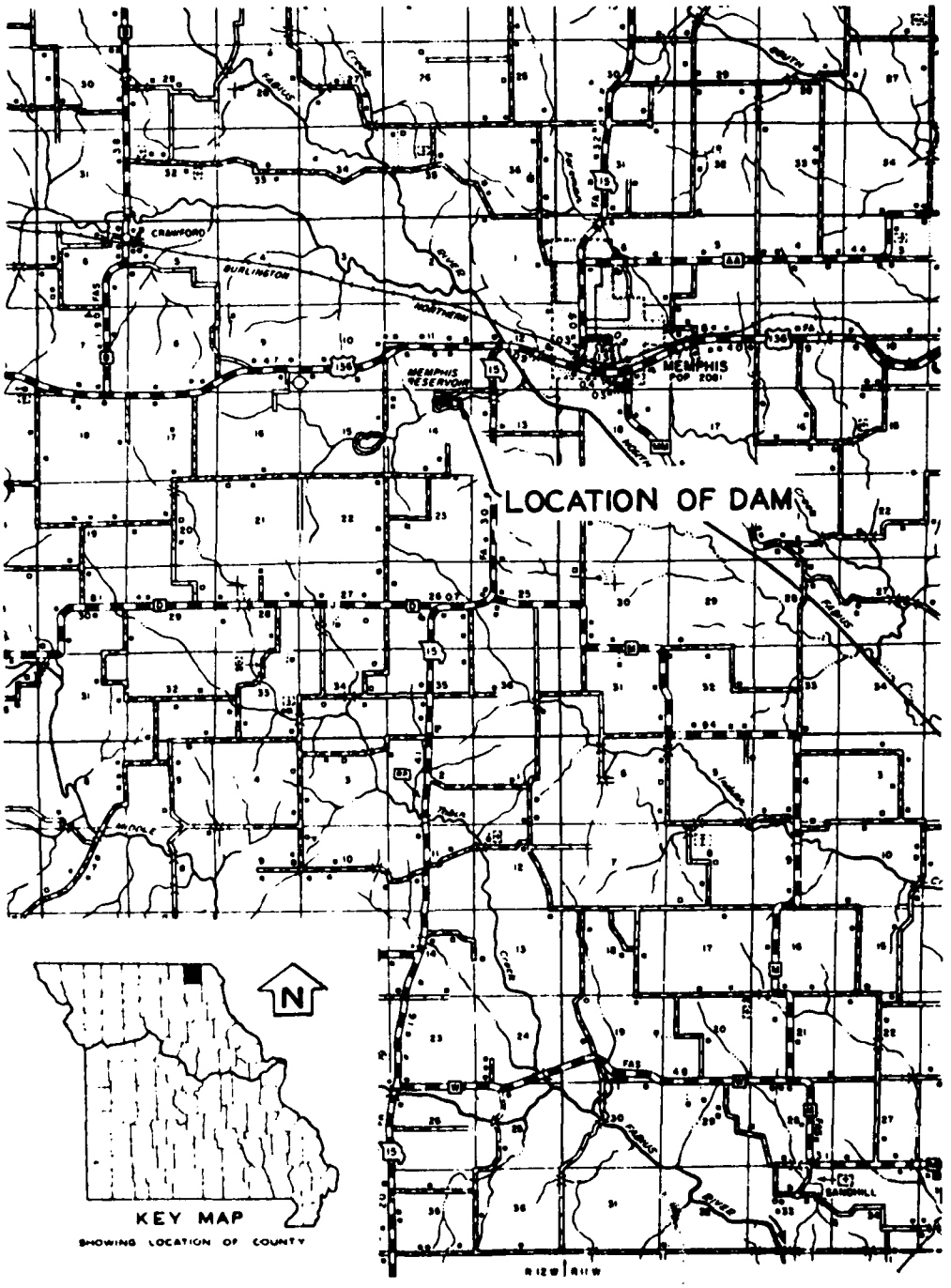
4. Cut the small trees and brush on the upstream embankment slope.

5. Clear the vegetation from the approach channels of the spillways.

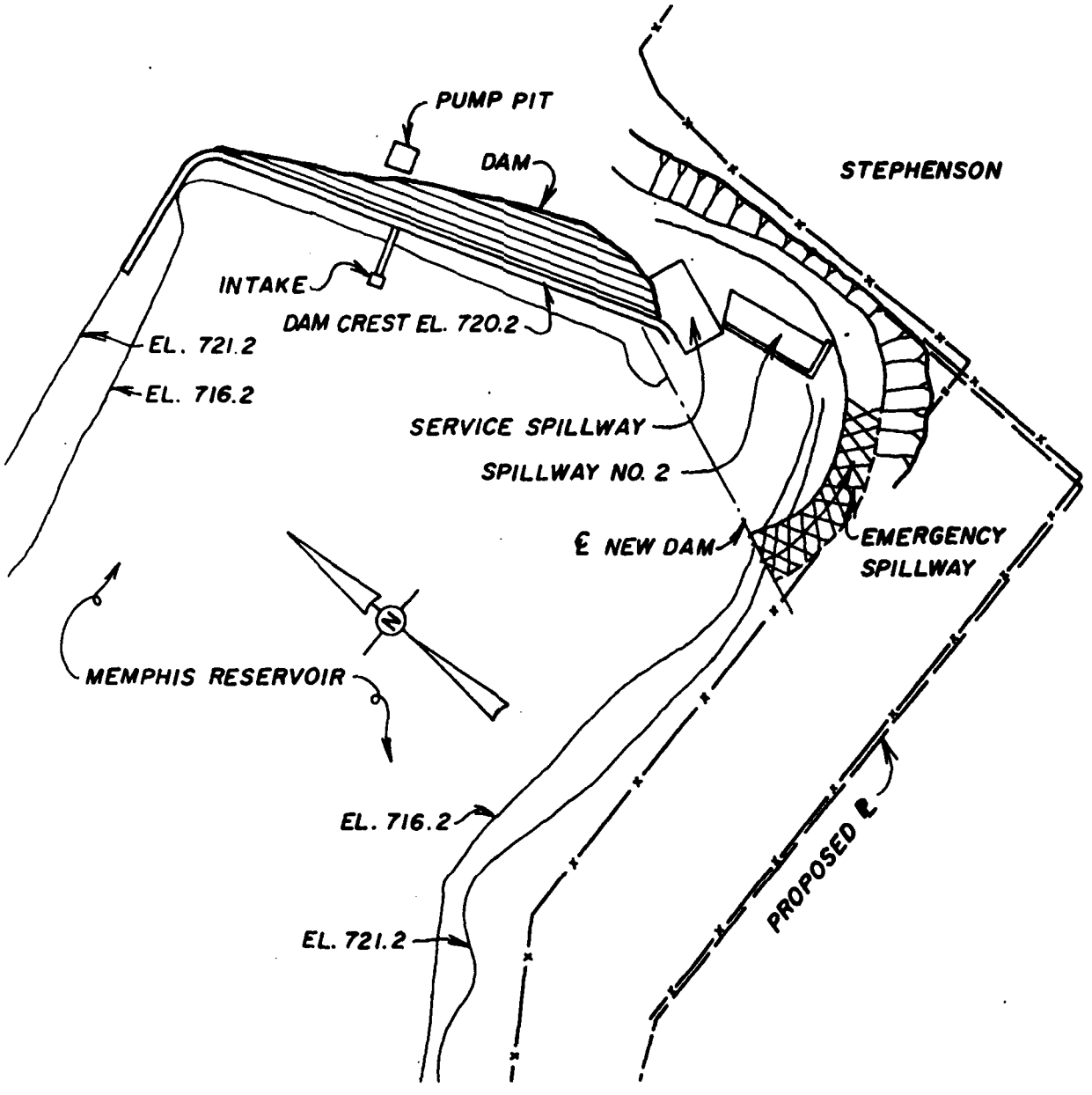
6. Patch the eroded and spalled concrete on the spillway structure as it becomes necessary.

7. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of dams.

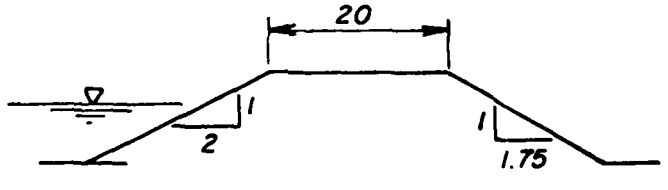
PLATES



LOCATION MAP
MEMPHIS RESERVOIR DAM
SCOTLAND COUNTY, MISSOURI

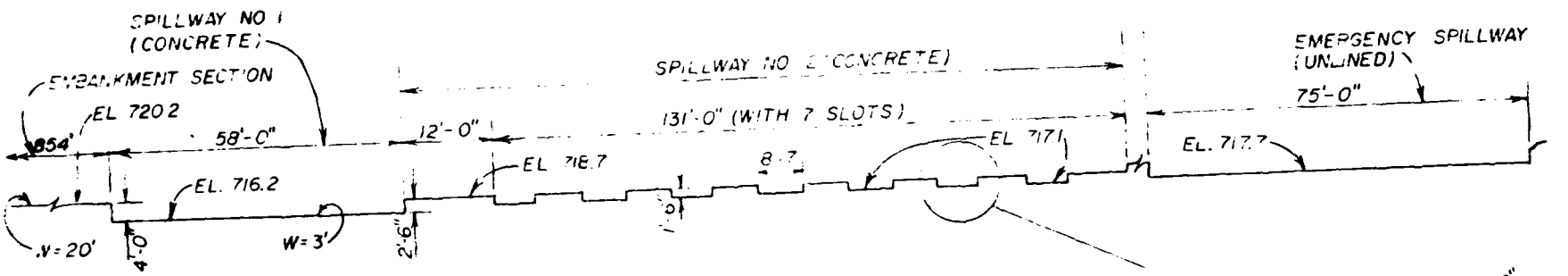


PLAN



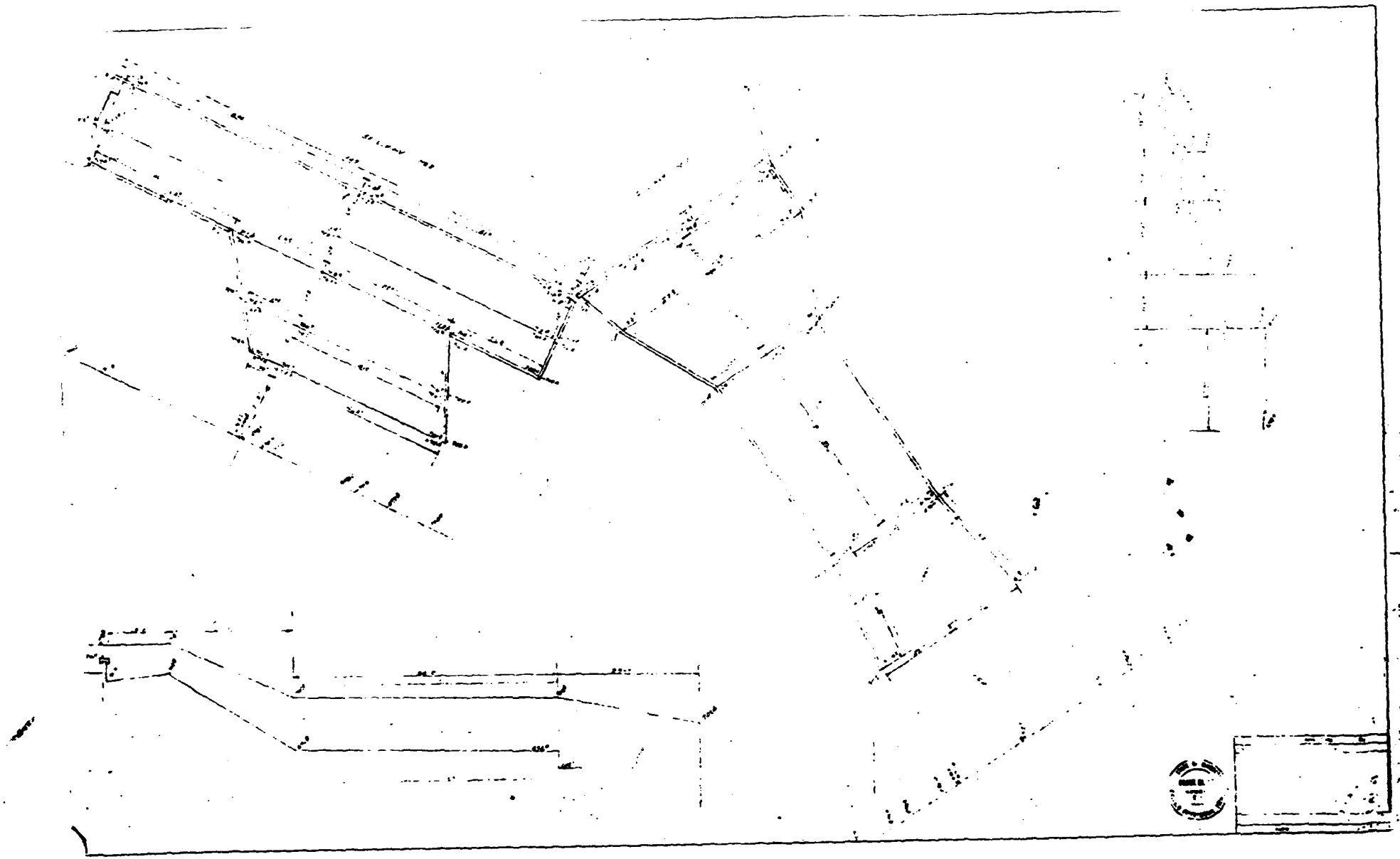
TYPICAL SECTION

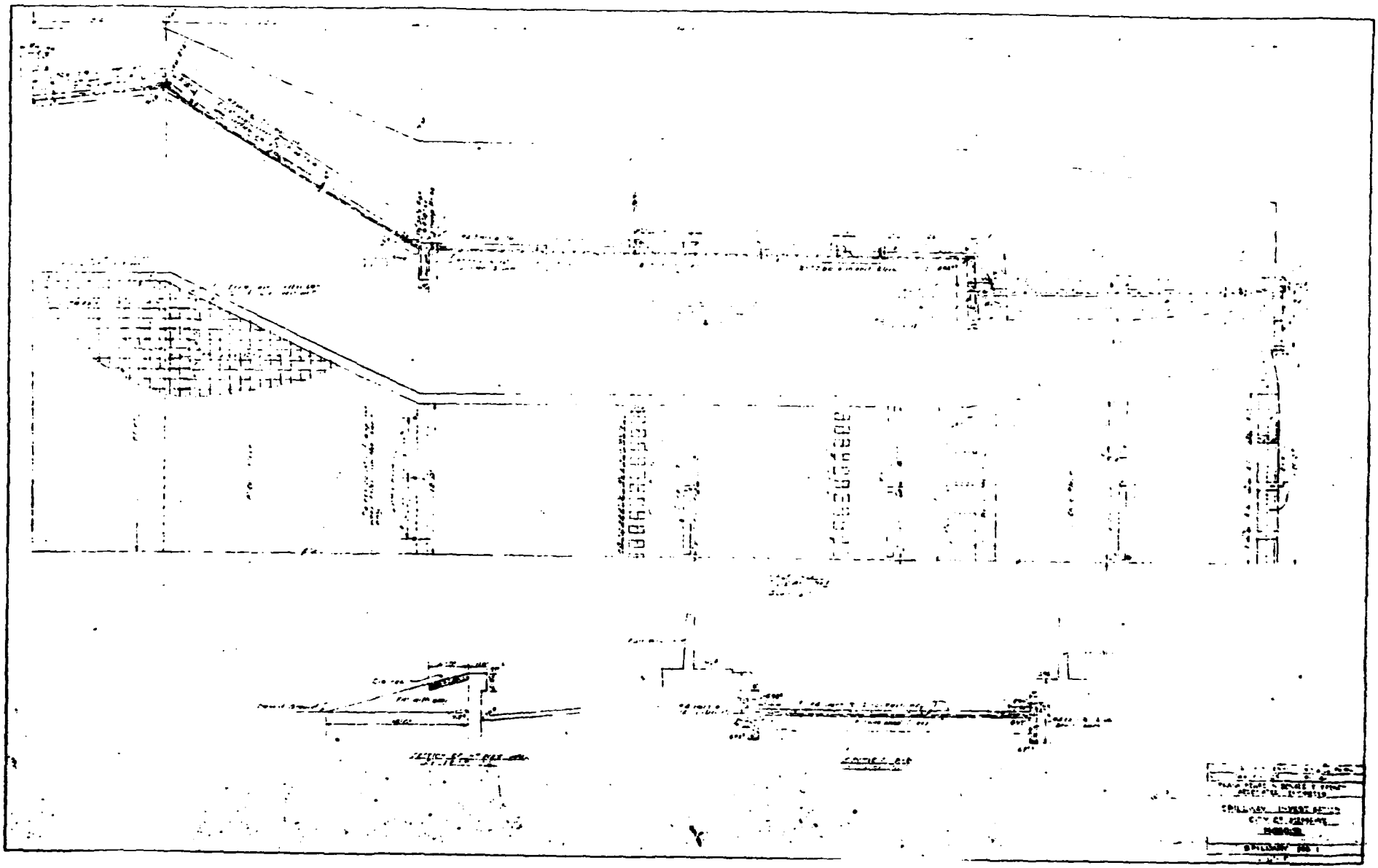
MEMPHIS RESERVOIR DAM
PLAN AND SECTION

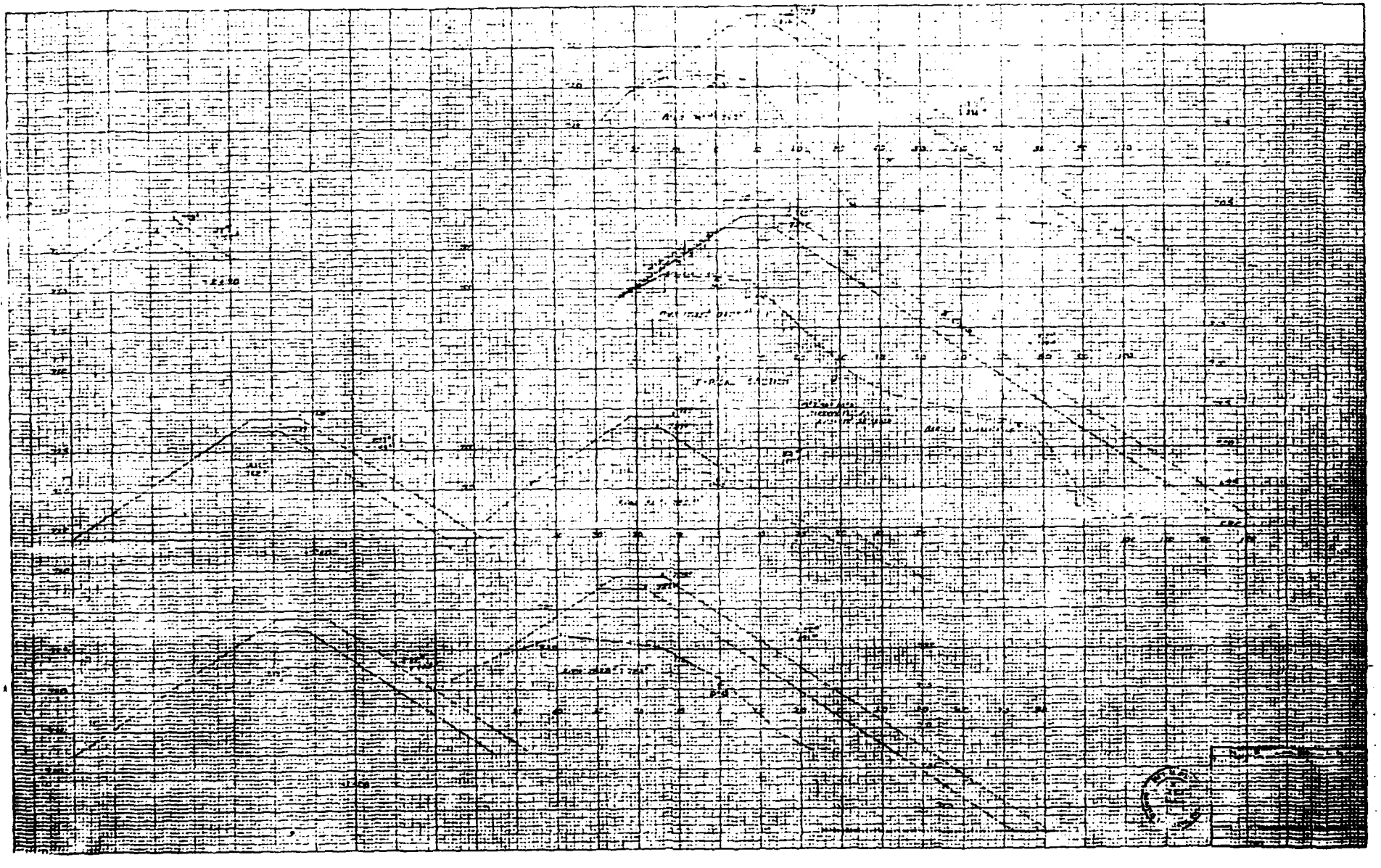


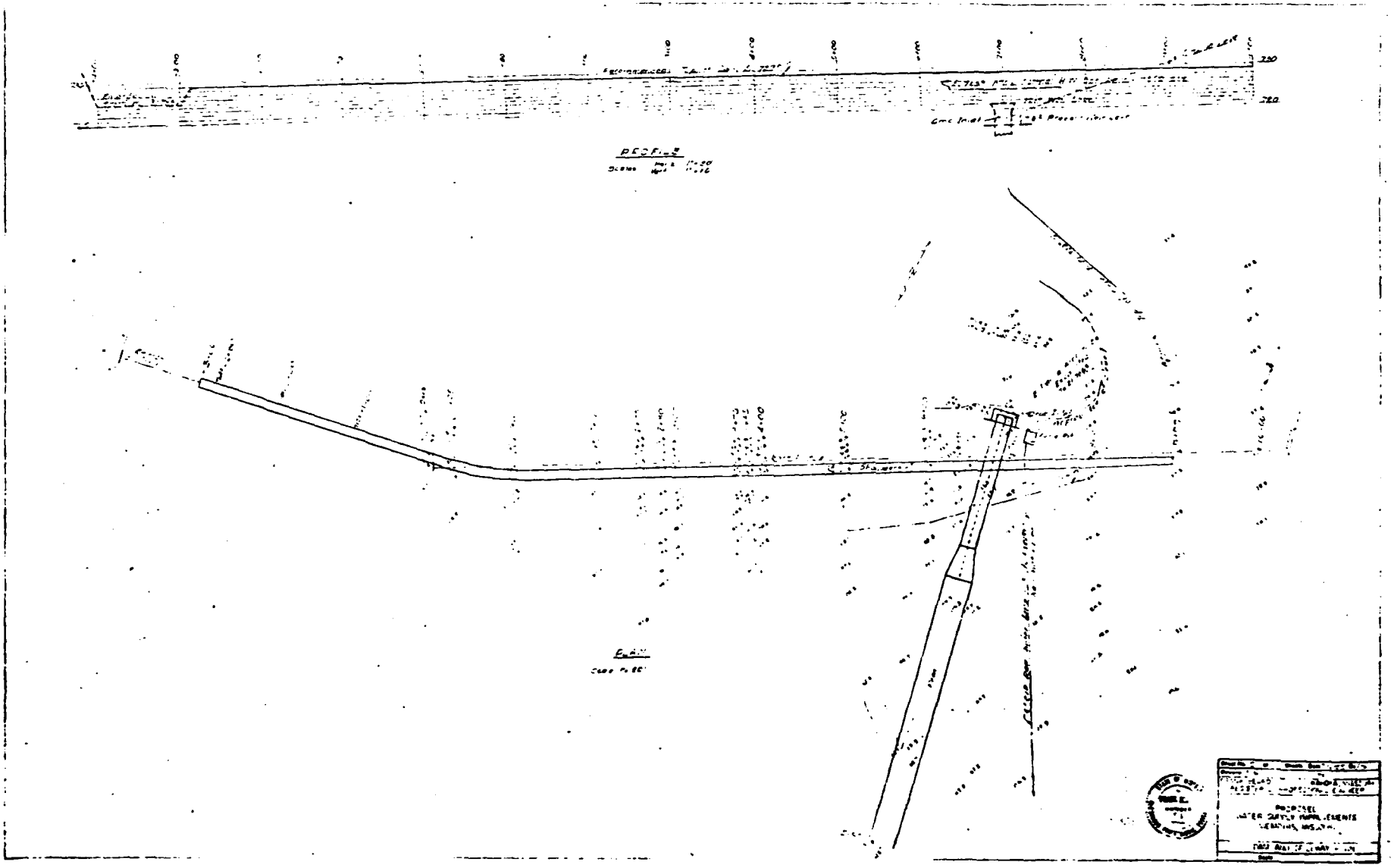
RELATIVE ELEVATION OF SPILLWAY CRESTS
LOOKING DOWNSTREAM
SCALE
20 0 20

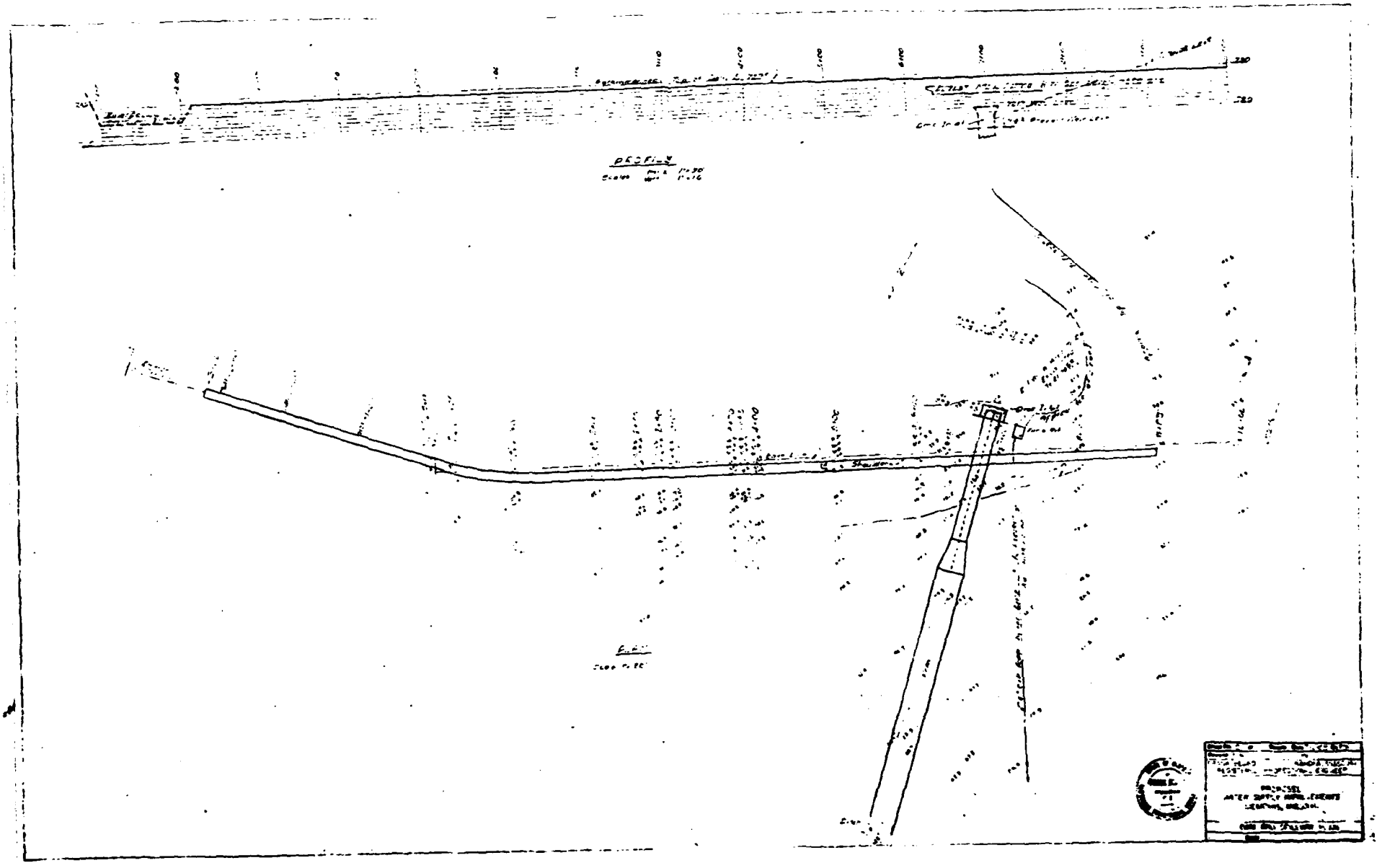
MEMPHIS LAKE DAM

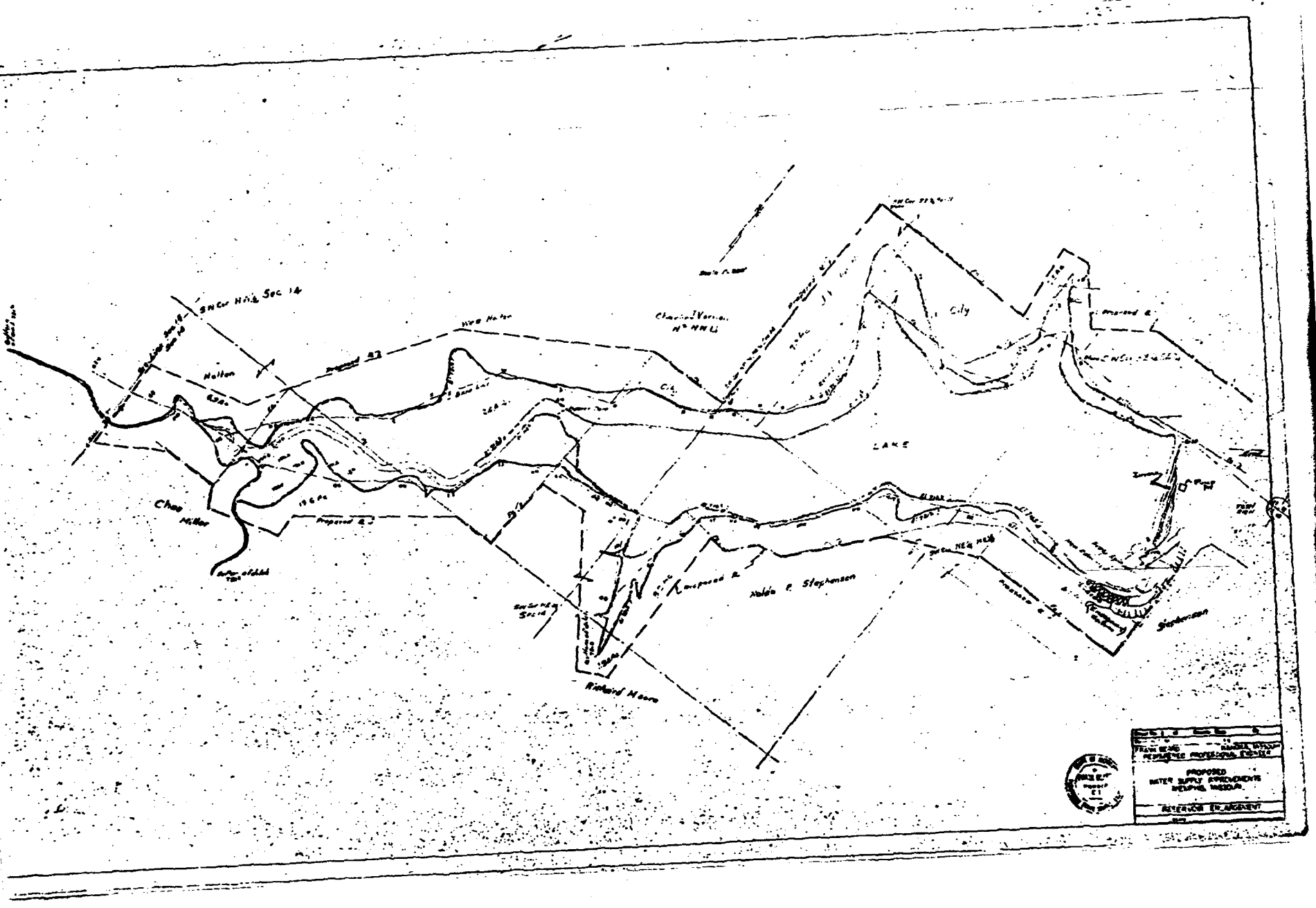


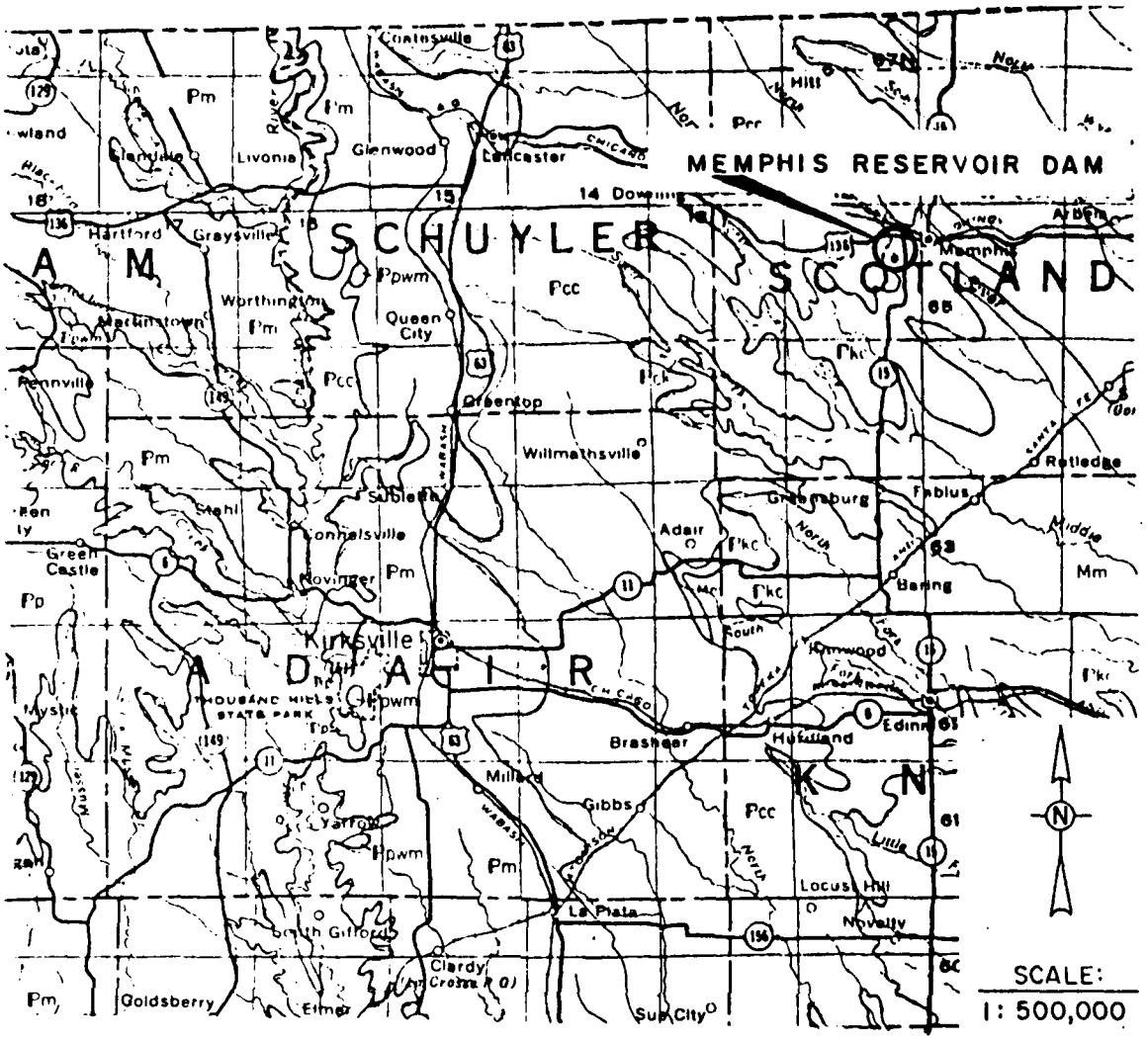









LAKE
Richard Moore
Stephenson
PROPOSED
WATER SUPPLY IMPROVEMENTS
KEENE, NEW HAMPSHIRE
RESERVOIR ENLARGEMENT



Explanation

Pennsylvanian System

P_{kc} - Kansas City group: cyclic deposits with numerous limestones.
P_{pwm} - Pleasanton group: sandstone channel member.
P_{m} - Marmaton group: cyclic deposits with limestones.
P_{cc} - Cherokee group: cyclic deposits, predominately shale, sandstone and coal beds.

Mississippian System

M_{m} - sandy, oolitic, fossiliferous, lithographic, or cherty limestones.
M_{o} - cherty, crinoidal limestone, with some shale.
M_{k} - intercalated limestones and shales.

Reference: Geologic Map of Missouri, 1961, Division of Geological Survey and Water Resources, State of Missouri.

General Geologic Map

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

MEMPHIS RESERVOIR DAM

Photo 1 - View along crest of dam taken from near left abutment.

Photo 2 - Picture of upstream slope of embankment taken from left side of dam.

Photo 3 - Picture of crest and downstream embankment slope taken from near center of dam looking toward left abutment.

Photo 4 - Picture of downstream embankment slope taken from near center of dam looking toward left abutment.

Photo 5 - Picture of intake structure for water supply piping.

Photo 6 - Picture of pump house vault for water supply.

Photo 7 - Picture of downstream channel of spillway taken from near center of dam toward right side of dam.

Photo 8 - Picture of concrete overflow crest of service spillway taken at left side of spillway.

Photo 9 - Picture of concrete overflow of service spillway taken from downstream of spillway.

Photo 10 - Picture of downstream discharge channel with energy dissipators below service spillway.

Photo 11 - Picture of emergency spillway approach channel and crest.

Photo 12 - Picture of crest of emergency spillway and failed downstream wall taken from right abutment of spillway.

Photo 13 - Picture of drop downstream of emergency spillway.

Photo 1 - View along crest of dam taken from near left abutment.

Photo 2 - Picture of upstream slope of embankment taken from left side of dam.

Photo 3 - Picture of crest and downstream embankment slope taken from near center of dam looking toward left abutment.

Photo 4 - Picture of downstream embankment slope taken from near center of dam looking toward left abutment.

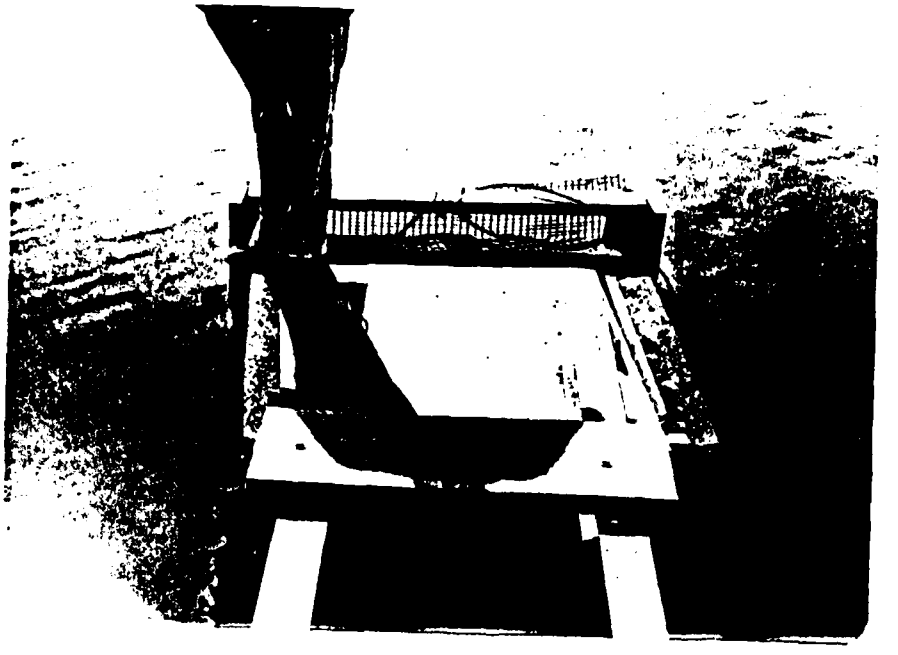


Photo 5 - Picture of intake structure for water supply piping.

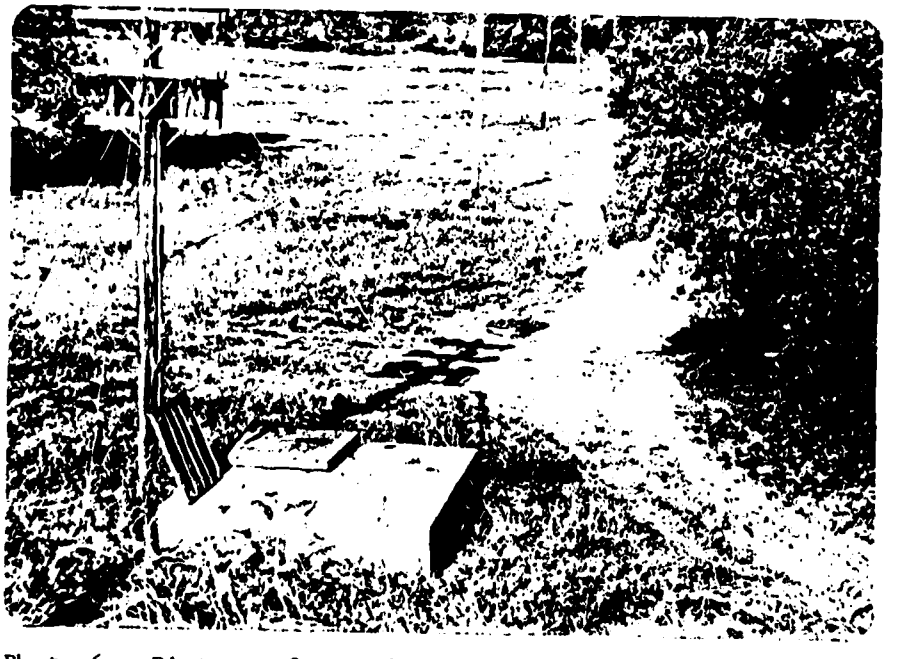


Photo 6 - Picture of pump house vault for water supply.

Photo 7 - Picture of downstream channel of spillway taken from near center of dam toward right side of dam.

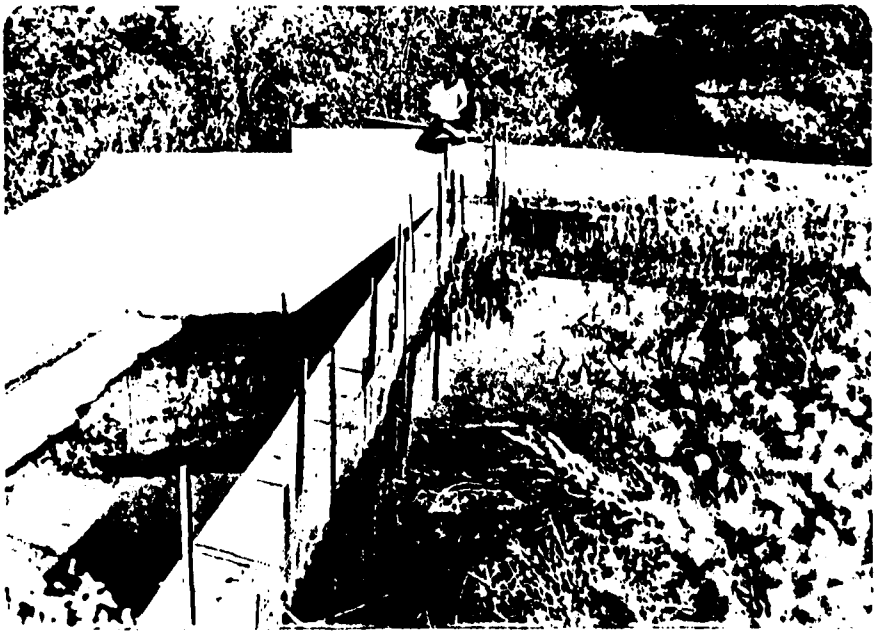


Photo 8 - Picture of concrete overflow crest of service spillway taken at left side of spillway.

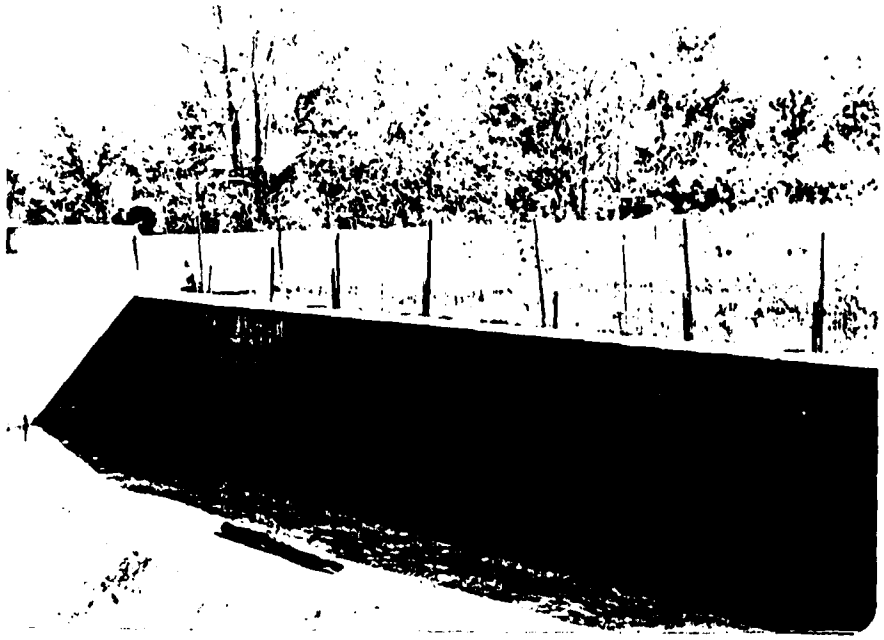


Photo 9 - Picture of concrete overflow of service spillway taken from downstream of spillway.

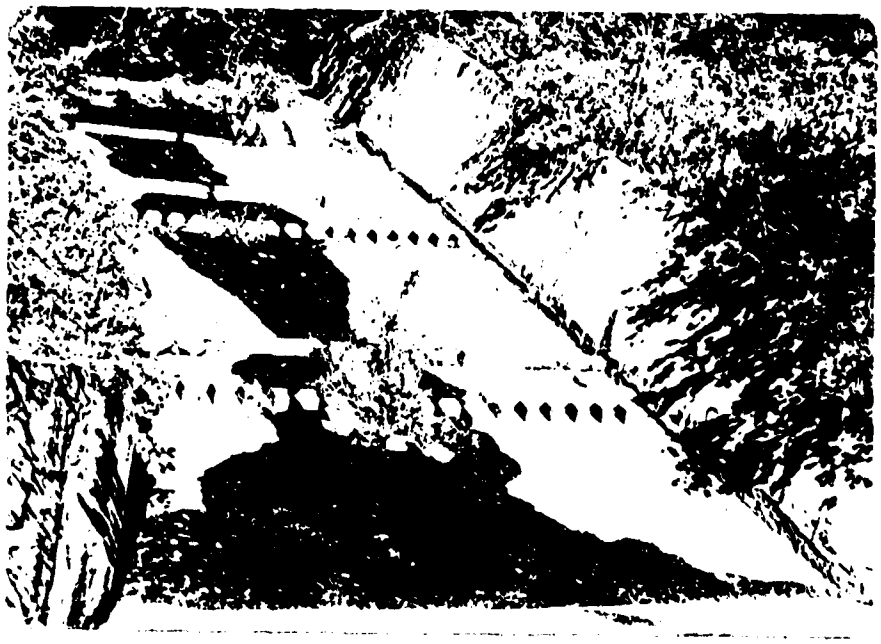


Photo 10 - Picture of downstream discharge channel with energy dissipators below service spillway.

Photo 11 - Picture of emergency spillway approach channel and crest.

Photo 12 - Picture of crest of emergency spillway and failed downstream wall taken from right abutment of spillway.

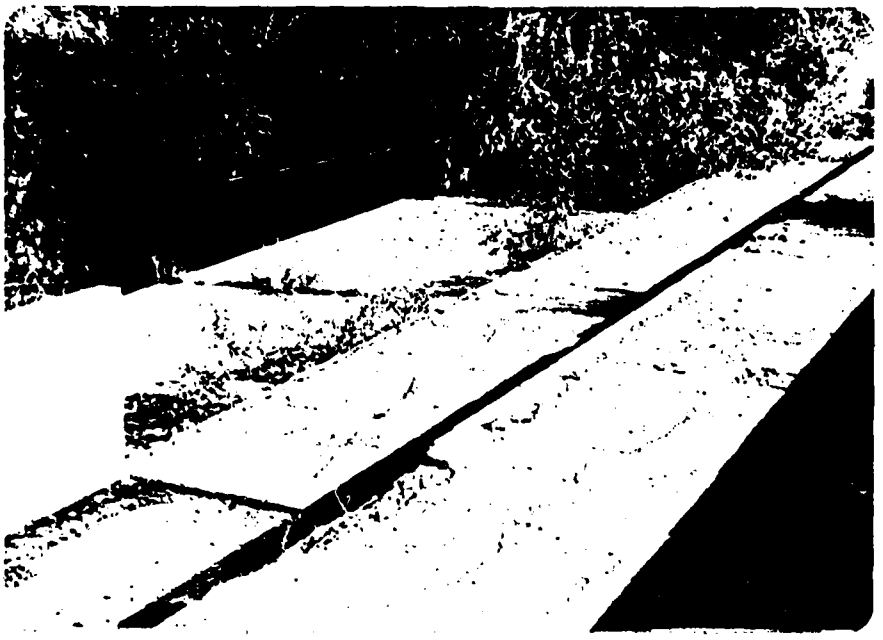
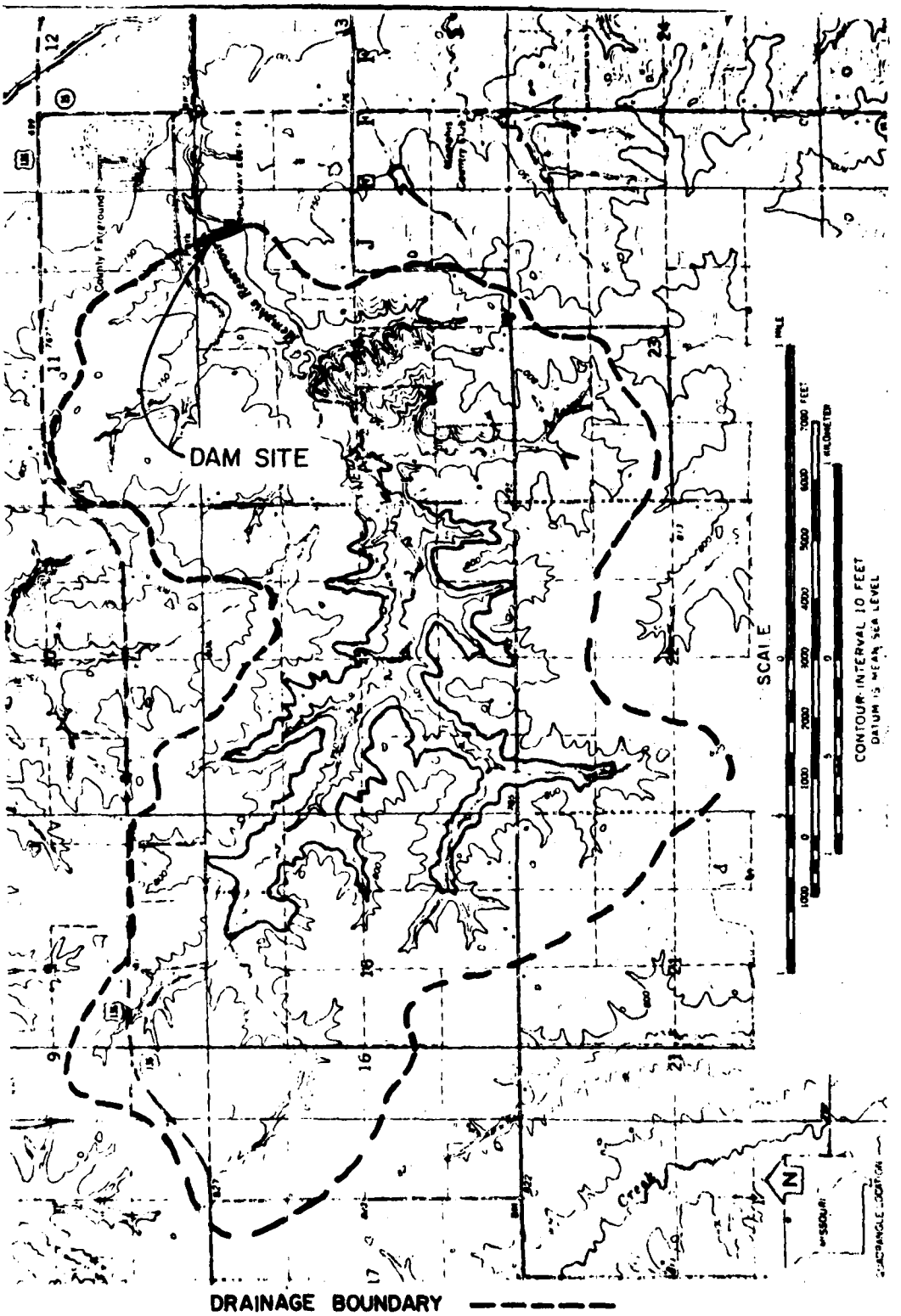


Photo 13 - Picture of emergency spillway downstream of concrete weir.

APPENDIX B

HYDROLOGIC COMPUTATIONS



MEMPHIS RESERVOIR DAM
DRAINAGE AREA

ENGINEERING CONSULTANTS, INC.

MISSOURI DAM SAFETY INSPECTION
MEMPHIS RESERVOIR DAM (OLD.)
RESERVOIR AREA CAPACITY DATA

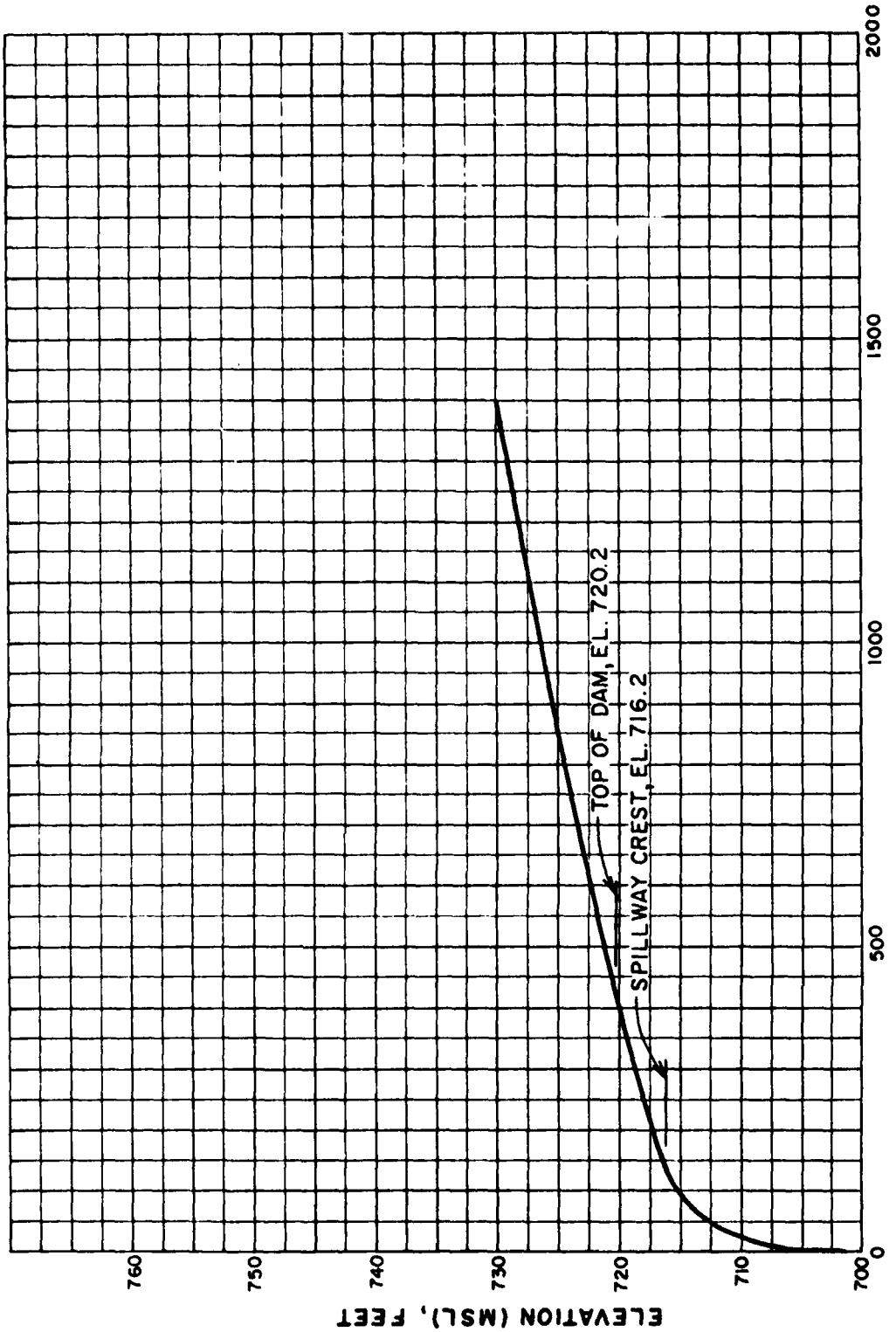
SHEET NO. 1 OF
JOB NO. 1223-001-1
BY KLB DATE 11-10-78

MEMPHIS RESERVOIR DAM (OLD)

RESERVOIR AREA CAPACITY DATA.

ELEV. FT.	RESERVOIR SURFACE AREA (ACRES)	INCREMENTAL VOLUME (AC-FT)	TOTAL VOLUME (AC-FT)	REMARKS
701	0.6	—	0	ASSUMED STREAMBED AT CENTER OF DAM
706	4.8	9.0	9.0	DATA FROM CONSTRUCTION PLANS
711	21.2	64.9	73.9	DATA FROM CONSTRUCTION PLANS
716	40.0	152.9	226.8	DATA FROM CONSTRUCTION PLANS
716.2	40.6 *	8	235.0*	SPILLWAY CREST EL.
720	51.9	173.5	410.5	DATA FROM CONSTRUCTION PLANS
720.2	53.8*	10.6	421.0*	TOP OF DAM.
730	145.4	976.0	1397.0	AREA FROM U.S.G.S. MAP
740	259.1	2022.5	3419.5	AREA FROM U.S.G.S. MAP.

* INTERPOLATED DATA

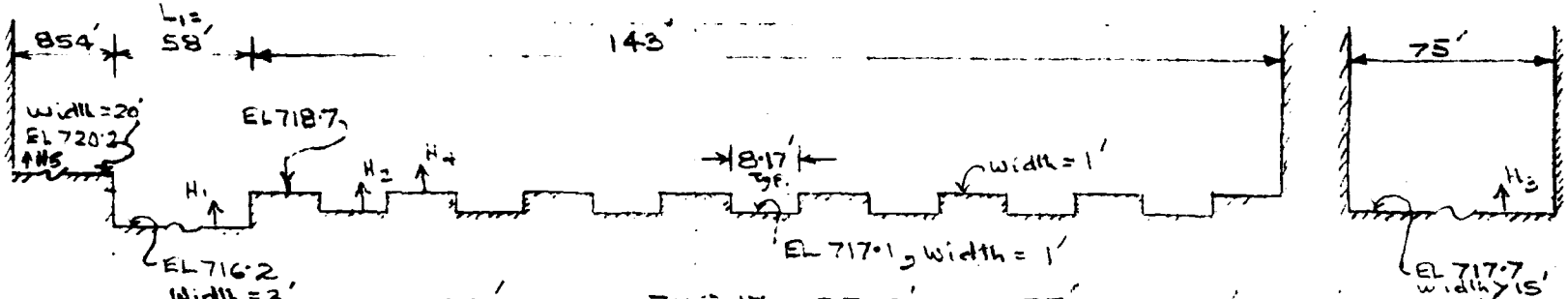


MEMPHIS RESERVOIR DAM
RESERVOIR CAPACITY CURVE

DAM SAFETY INSPECTION / MISSOURI

MEMPHIS RESERVOIR DAM

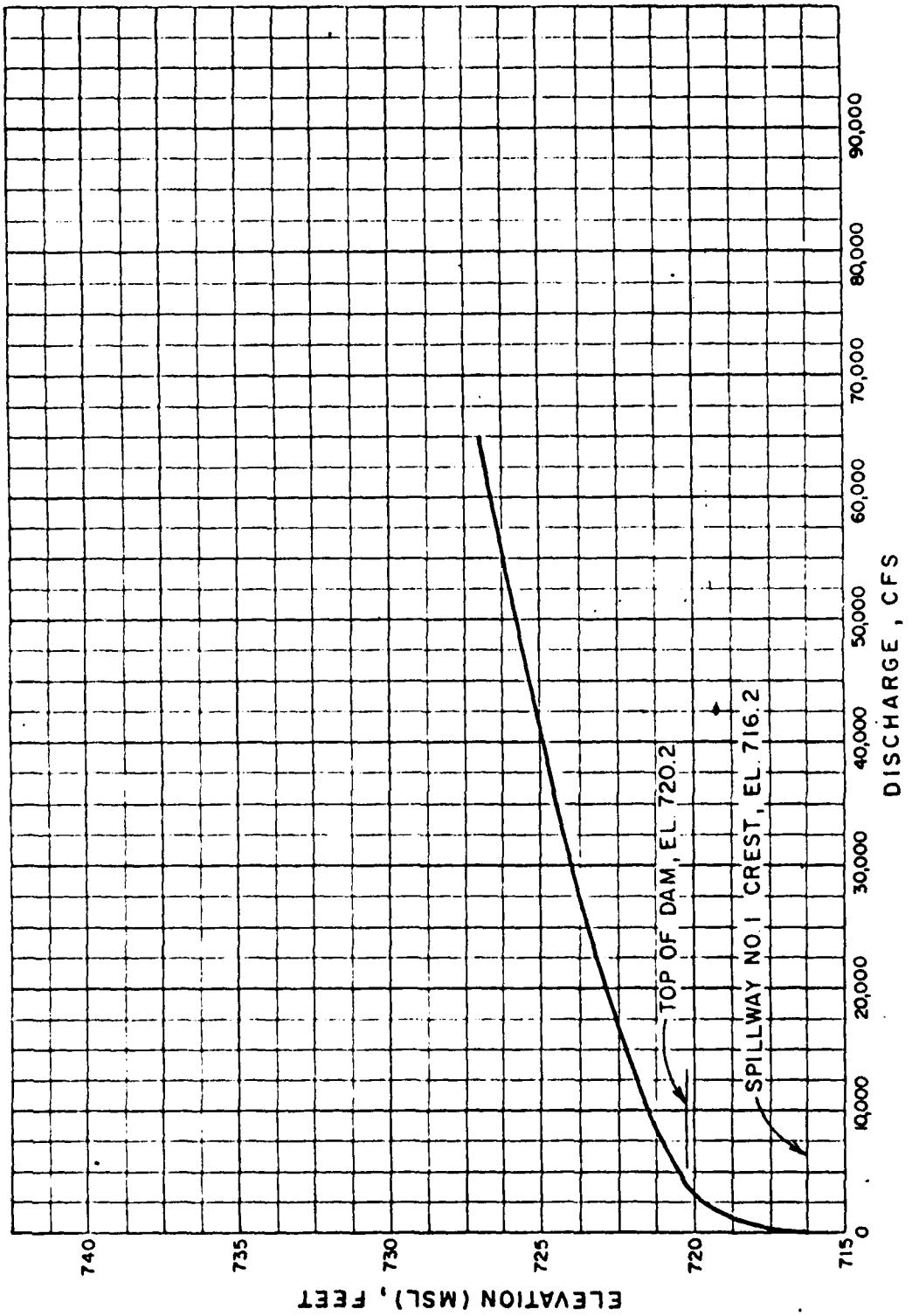
SPILLWAY & OVERFLOW DISCHARGE CAPACITY



$L_1 = 58'$, $L_2 = 7 \times 8.17 = 57.19'$, $L_3 = 75'$, $L_4 = 143 - 57.19 = 85.81'$

$L_5 = 854'$

ELEV. FT.	H_1	H_2	H_3	H_4	H_5	L_1	L_2	L_3	L_4	L_5	C_1	C_2	C_3	C_4	C_5	$Q = \sum_{i=1}^{5} C_i L_i H_i^{3/2}$
716.2	0.0					58					-					0.0
716.7	0.5					58					2.63					54
717.1	0.9	0.0				58	57.19				2.66	-				132
717.4	1.2	0.3				58	57.19				2.64	2.71				226
717.7	1.5	0.6	0.0			58	57.19	75			2.66	2.75	-			356
718.2	2.0	1.1	0.5			58	57.19	75			2.72	3.03	2.70			718
718.7	2.5	1.6	1.0	0.0		58	57.19	75	85.81		2.81	3.28	2.63	-		1221
719.5	3.3	2.4	1.8	0.8		58	57.19	75	85.81		2.95	3.31	2.63	2.85		2381
720.2	4.0	3.1	2.5	1.5	0.0	58	57.19	75	85.81	854	3.07	3.32	2.63	3.24	-	3751
721.0	4.8	3.9	3.3	2.3	0.8	58	57.19	75	85.81	854	3.32	3.32	2.63	3.31	2.69	7273
723.0	6.8	5.9	5.3	4.3	2.8	58	57.19	75	85.81	854	3.32	3.32	2.63	3.32	2.63	21606
725.0	8.8	7.9	7.3	6.3	4.8	58	57.19	75	85.81	854	3.32	3.32	2.63	3.32	2.63	41258
727.0	10.8	9.9	9.3	8.3	6.8	58	57.19	75	85.81	854	3.32	3.32	2.63	3.32	2.63	64981
730.0	13.8	12.9	12.3	11.3	9.8	58	57.19	75	85.81	854	3.32	3.32	2.63	3.32	2.63	103525



MEMPHIS RESERVOIR DAM
SPILLWAY & OVERTOP RATING
CURVE

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI
MEMPHIS RESERVOIR DAM
UNIT HYDROGRAPH PARAMETERS

SHEET NO. 1 OF
JOB NO. 1223-001-1
BY KLB DATE 11-7-78

1. DRAINAGE AREA, $A = 947\ AC = \underline{1.48}$ SQ. MI

2. LENGTH OF STREAM, $L = 1.44$ MI

3. DIFFERENCE IN EL., $\Delta H = 815 - 719 = 96$ FT.

4. TIME OF CONCENTRATION, T_c

$$T_c = \left(\frac{11.9 \times L^3}{\Delta H}\right)^{0.385}$$

$$T_c = \left(\frac{11.9 \times 1.44^3}{96}\right)^{0.385}$$

$$T_c = \underline{0.68}$$

5. LAG TIME, $L_t = 0.6 \times T_c$

$$L_t = 0.6 \times 0.68 = 0.41$$

6. RAINFALL UNIT DURATION, D

$$D \leq \frac{L_t}{4} = \frac{0.41}{4} = 0.10$$

USE $D = 5\ MIN = 0.083$ HR

TO MATCH UPSTREAM CALCULATIONS

7. TIME TO PEAK, T_p

$$T_p = \frac{D}{2} + 0.6 \times T_c$$

$$T_p = \frac{0.083}{2} + 0.6 \times 0.68$$

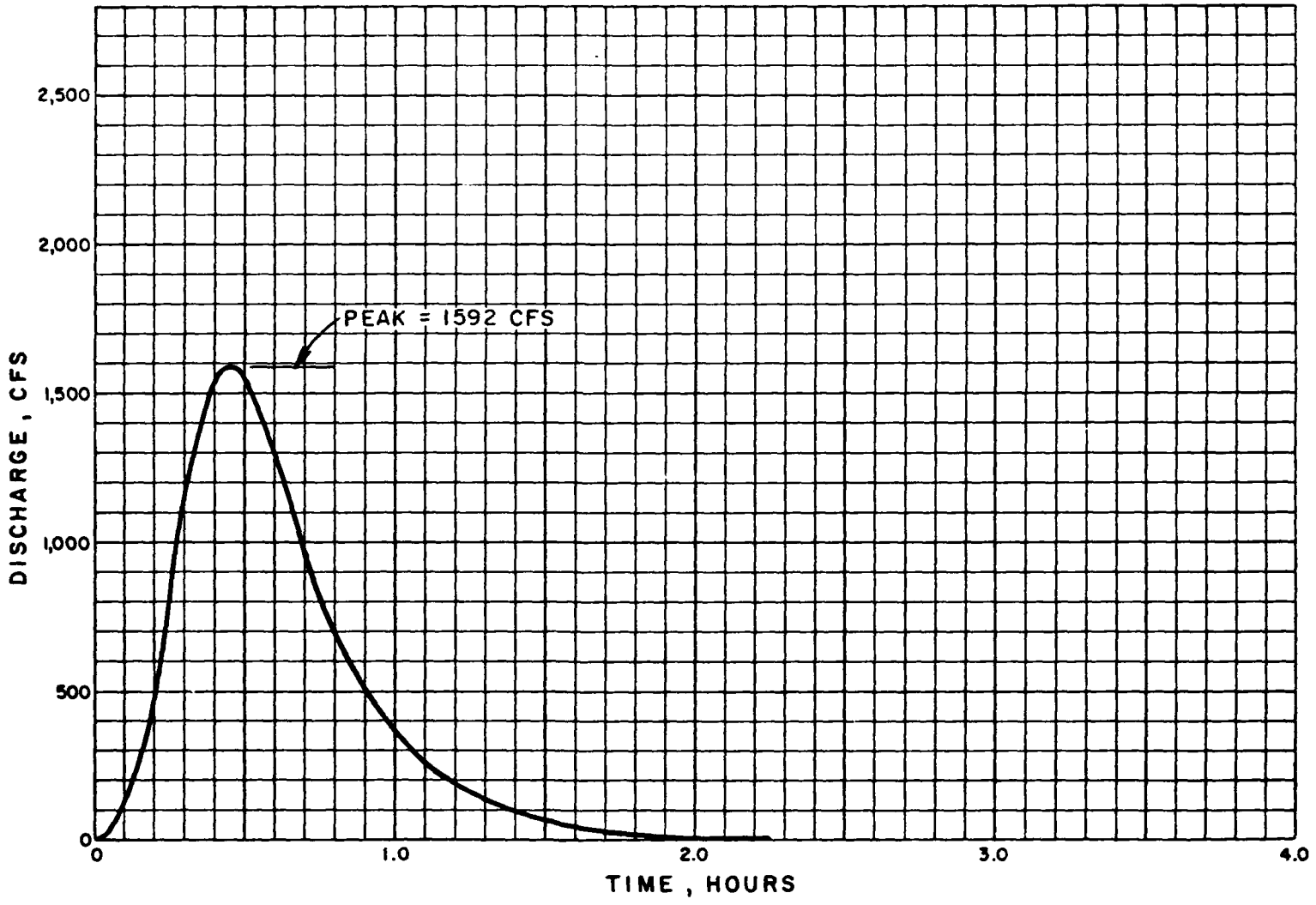
$$T_p = \underline{0.45\ HR.}$$

8. $q_p = \frac{484 \times A}{T_p} = \frac{484 \times 1.48}{0.45} = \underline{1592}$ CFS.

4) CURVILINEAR UNIT HYDROGRAPH

TIME, T/T_p	DISCHARGE RATIO q/q_p	UNIT HYDROGRAPH	
		TIME, T (HRS)	DISCHARGE q (CFS)
0.000	0.000	0.000	0.000
0.1	0.015	0.05	23.88
0.2	0.075	0.09	119.40
0.3	0.16	0.14	254.72
0.4	0.28	0.18	445.76
0.5	0.45	0.23	716.40
0.6	0.60	0.27	955.20
0.7	0.77	0.32	1225.84
0.8	0.89	0.36	1416.88
0.9	0.97	0.41	1549.24
1.0	1.00	0.45	1592.00
1.1	0.98	0.50	1560.16
1.2	0.92	0.54	1464.64
1.3	0.84	0.59	1337.28
1.4	0.75	0.63	1194.00
1.5	0.66	0.68	1050.72
1.6	0.56	0.72	891.52
1.8	0.42	0.81	668.64
2.0	0.32	0.90	509.44
2.2	0.24	0.99	382.08
2.4	0.18	1.08	286.56
2.6	0.13	1.17	206.96
2.8	0.098	1.26	156.02
3.0	0.075	1.35	119.40
3.5	0.036	1.58	57.31
4.0	0.018	1.80	28.66
4.5	0.009	2.03	14.33
5.0	0.004	2.25	6.37

MEMPHIS RESERVOIR DAM
5 MINUTE UNIT HYDROGRAPH



DETERMINATION OF PMS

1. Determine drainage area of the basin

   D.A. = 947 acres = 1.48 Sq. mi.

2. Determine PMP Index rainfall :

   Location of centroid of basin:

   Long. 92.21°; Lat.: 40.44°

   → PMP for 200 Sq. mi. & 24 hrs duration

   = 23.8" (from Fig 1, HMR No 33)

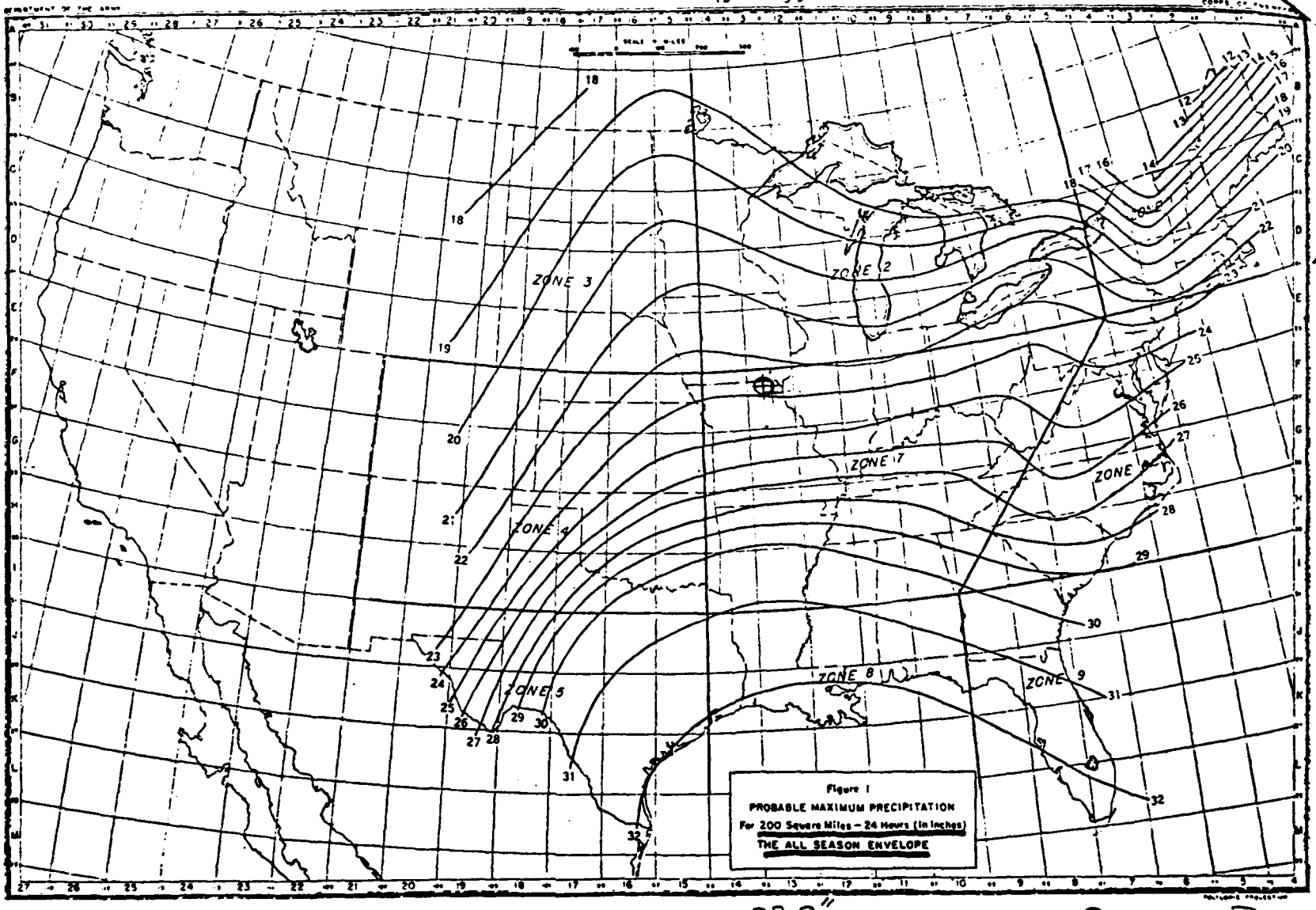
3. Determine basin rainfall interms of percentage of PMP Index rainfall for various durations;

   Location: Long. 92.21°; Lat. 40.44°

   ⇒ Zone 7

Duration (Hrs.)	Percent of Index rainfall (%)	Total rainfall (Inches)	Rainfall increments (Inches)	Duration of increment (Hrs.)
6	100	23.8	23.8	6
12	120	28.6	4.8	6
24	130	30.9	2.3	12

93 91 89



41
39
37

23·8"

MEMPHIS RESERVOIR DAM
DETERMINATION OF PMP

MEMPHIS RESERVOIR

100 YEAR FLOOD BY REGRESSION EQUATION

REGRESSION EQUATION FOR 100 YEAR FLOOD FOR MISSOURI:

$$Q_{100} = 85.1\, A^{0.934\, A^{-0.02}}\, S^{0.576}$$

WHERE:

A = DRAINAGE AREA IN SQ. MI,

S = MAIN CHANNEL SLOPE FT/MI.
(AVG. SLOPE BETWEEN 0.1L AND 0.85L
L, BEING LENGTH OF MAIN CHANNEL)

FOR MEMPHIS RESERVOIR:

A = 1.48 SQ. MI.

$$S = \frac{795 - 727}{0.75 \times 1.44} = 62.96 \text{ FT/MI.}$$

$$Q_{100} = 85.1\,(1.48)^{0.934\,(1.48)^{-0.02}}\,(62.96)^{0.576}$$

$$= \underline{1330 \text{ CFS}}$$

HEC1DB INPUT DATA

```
****************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION          JULY 1978
  LAST MODIFICATION  21 AUG 78
****************************************
A1                      DAM SAFETY INSPECTION - MISSOURI
A2                         MEMPHIS RESERVOIR (NEW AND OLD)
A3             PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING
B    300       0       5       0       0       0       0       0       0       0
B1     5
J      1       4       1
J1   1.0     0.5
K      0       3                                       1
K1     INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SCS UNIT HYDROGRAPH NEW
M      1      -1    3.05            3.05     1.0
P          23.80     100     120     130
T                                                   0.85    0.07
U     22
U1   0.0    440.   1800.   3500.   4342.   3920.   2940.   2100.   1450.   1020.
U1  700.    520.    360.    260.    170.    130.    100.     70.     50.     30.
U1   10.     0.0
X             0.       1
K      1       3                                       1
K1     ROUTE HYDROGRAPH THROUGH NEW MEMPHIS RESERVOIR
Y                              1       1
Y1                                                  -770.      -1
Y4770.00  771.00  772.00  773.00  774.00  775.49  776.96  779.86  781.20  782.71
Y4784.11
Y5    0.     88.    247.    445.    850.   1317.   2910.   7565.  14036.  28929.
Y546747.
$A    0.    20.4   301.1   998.8  2174.0  4108.9  5164.0  7030.0 10965.0
$E  725.    730.    740.    750.    760.    770.    774.    780.    790.
$S770.00
$D780.00
K      0      18                                       1
K1     INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SCS UNIT HYDROGRAPH OLD
M      1      -1    1.48            1.48     1.0
P          23.80     100     120     130
T                                                   0.85    0.07
U     31
U1   0.0      15     170     470    1050    1420    1592    1492    1360     950
U1   730     560     430     360     206     188     140     112      80      60
U1    42      34      30      20      17      14      11       8       5       2
U1   0.0
X             0.       1
K      2      18                                       1
K1   COMBINE UPSTREAM ROUTED HYDROGRAPH WITH DOWNSTREAM HYDROGRAPH BEFORE ROUTING
K      1      18                       2               1
K1    ROUTE COMBINED HYDROGRAPH THROUGH OLD MEMPHIS RESERVOIR AND DAM
Y                              1       1
Y1     1                                            -716.2      -1
Y4 716.2   716.7   717.1   717.4   718.2   718.7   719.5   720.2   721.0   723.0
Y4 725.0   727.0   730.0
Y5   0.0      54     132     226     356     718    1221    2301    3751    7273
Y5 21600   41250   64981  103525
```

```
91                  98   0.0     0.0   731.9   228.8   835.0   618.5   421.0  1397.0  3419.5
92                  9E   701     706    711     716   948.2   780.0   720.2     730     740
93                  88 716.8
94                  88 720.2
95                  K    99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	43
ROUTE HYDROGRAPH TO	3
RUNOFF HYDROGRAPH AT	18
COMBINE 2 HYDROGRAPHS AT	18
ROUTE HYDROGRAPH TO	18
END OF NETWORK	

INFLOW PMF AND ONE-HALF PMF HYDROGRAPH COMPUTATION FOR NEW MEMPHIS RESERVOIR

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  31 AUG 78
**********

RUN  DATE= 78/11/29.
     TIME= 12.19.50.
```

DAM SAFETY INSPECTION - MISSOURI
MEMPHIS RESERVOIR (NEW AND OLD)
PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING

JOB SPECIFICATION

NO	NMR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	0	5	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1

RTIOS= 1.00 .50

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SCS UNI

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	-1	3.05	0.00	3.09	1.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.60	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	.85	.07	0.00	0.00

GIVEN UNIT GRAPH, NUHGS= 22

0.	880.	1880.	3520.	4582.	3920.	2940.	2100.	1450.	1020.
700.	580.	500.	200.	170.	130.	100.	70.	50.	30.
20.	0.								

UNIT GRAPH TOTALS 23932. CFS OR 1.01 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

NO,DA	HR,MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO,DA	HR,MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

1.01	5.05	61	.01	0.00	.01	0.	1.01	17.35	211	.22	.21	.01	9901.
1.01	5.10	62	.01	0.00	.01	0.	1.01	17.40	212	.22	.21	.01	9574.
1.01	5.15	63	.01	0.00	.01	0.	1.01	17.45	213	.22	.21	.01	9306.
1.01	5.20	64	.01	0.00	.01	0.	1.01	17.50	214	.22	.21	.01	9124.
1.01	5.25	65	.01	.01	.01	0.	1.01	17.55	215	.22	.21	.01	5101.
1.01	5.30	66	.01	.01	.01	2.	1.01	18.00	216	.22	.21	.01	5192.
1.01	5.35	67	.01	.01	.01	13.	1.01	18.05	217	.02	.01	.01	5130.
1.01	5.40	68	.01	.01	.01	35.	1.01	18.10	218	.02	.01	.01	5088.
1.01	5.45	69	.01	.01	.01	65.	1.01	18.15	219	.02	.01	.01	4690.
1.01	5.50	70	.01	.01	.01	95.	1.01	18.20	220	.02	.01	.01	3955.
1.01	5.55	71	.01	.01	.01	119.	1.01	18.25	221	.02	.01	.01	3088.
1.01	6.00	72	.01	.01	.01	136.	1.01	18.30	222	.02	.01	.01	2300.
1.01	6.05	73	.07	.06	.01	148.	1.01	18.35	223	.02	.01	.01	1780.
1.01	6.10	74	.07	.06	.01	180.	1.01	18.40	224	.02	.01	.01	1302.
1.01	6.15	75	.07	.06	.01	281.	1.01	18.45	225	.02	.01	.01	1018.
1.01	6.20	76	.07	.06	.01	472.	1.01	18.50	226	.02	.01	.01	811.
1.01	6.25	77	.07	.06	.01	704.	1.01	18.55	227	.02	.01	.01	672.
1.01	6.30	78	.07	.06	.01	914.	1.01	19.00	228	.02	.01	.01	569.
1.01	6.35	79	.07	.06	.01	1071.	1.01	19.05	229	.02	.01	.01	498.
1.01	6.40	80	.07	.06	.01	1183.	1.01	19.10	230	.02	.01	.01	446.
1.01	6.45	81	.07	.06	.01	1260.	1.01	19.15	231	.02	.01	.01	412.
1.01	6.50	82	.07	.06	.01	1315.	1.01	19.20	232	.02	.01	.01	387.
1.01	6.55	83	.07	.06	.01	1352.	1.01	19.25	233	.02	.01	.01	367.
1.01	7.00	84	.07	.06	.01	1380.	1.01	19.30	234	.02	.01	.01	353.
1.01	7.05	85	.07	.06	.01	1399.	1.01	19.35	235	.02	.01	.01	343.
1.01	7.10	86	.07	.06	.01	1413.	1.01	19.40	236	.02	.01	.01	337.
1.01	7.15	87	.07	.06	.01	1422.	1.01	19.45	237	.02	.01	.01	335.
1.01	7.20	88	.07	.06	.01	1429.	1.01	19.50	238	.02	.01	.01	335.
1.01	7.25	89	.07	.06	.01	1434.	1.01	19.55	239	.02	.01	.01	335.
1.01	7.30	90	.07	.06	.01	1436.	1.01	20.00	240	.02	.01	.01	335.
1.01	7.35	91	.07	.06	.01	1440.	1.01	20.05	241	.02	.01	.01	335.
1.01	7.40	92	.07	.06	.01	1442.	1.01	20.10	242	.02	.01	.01	335.
1.01	7.45	93	.07	.06	.01	1443.	1.01	20.15	243	.02	.01	.01	335.
1.01	7.50	94	.07	.06	.01	1443.	1.01	20.20	244	.02	.01	.01	335.
1.01	7.55	95	.07	.06	.01	1443.	1.01	20.25	245	.02	.01	.01	335.
1.01	8.00	96	.07	.06	.01	1443.	1.01	20.30	246	.02	.01	.01	335.
1.01	8.05	97	.07	.06	.01	1443.	1.01	20.35	247	.02	.01	.01	335.
1.01	8.10	98	.07	.06	.01	1443.	1.01	20.40	248	.02	.01	.01	335.
1.01	8.15	99	.07	.06	.01	1443.	1.01	20.45	249	.02	.01	.01	335.
1.01	8.20	100	.07	.06	.01	1443.	1.01	20.50	250	.02	.01	.01	335.
1.01	8.25	101	.07	.06	.01	1443.	1.01	20.55	251	.02	.01	.01	335.
1.01	8.30	102	.07	.06	.01	1443.	1.01	21.00	252	.02	.01	.01	335.
1.01	8.35	103	.07	.06	.01	1443.	1.01	21.05	253	.02	.01	.01	335.
1.01	8.40	104	.07	.06	.01	1443.	1.01	21.10	254	.02	.01	.01	335.
1.01	8.45	105	.07	.06	.01	1443.	1.01	21.15	255	.02	.01	.01	335.
1.01	8.50	106	.07	.06	.01	1443.	1.01	21.20	256	.02	.01	.01	335.
1.01	8.55	107	.07	.06	.01	1443.	1.01	21.25	257	.02	.01	.01	335.
1.01	9.00	108	.07	.06	.01	1443.	1.01	21.30	258	.02	.01	.01	335.
1.01	9.05	109	.07	.06	.01	1443.	1.01	21.35	259	.02	.01	.01	335.
1.01	9.10	110	.07	.06	.01	1443.	1.01	21.40	260	.02	.01	.01	335.
1.01	9.15	111	.07	.06	.01	1443.	1.01	21.45	261	.02	.01	.01	335.
1.01	9.20	112	.07	.06	.01	1443.	1.01	21.50	262	.02	.01	.01	335.
1.01	9.25	113	.07	.06	.01	1443.	1.01	21.55	263	.02	.01	.01	335.
1.01	9.30	114	.07	.06	.01	1443.	1.01	22.00	264	.02	.01	.01	335.
1.01	9.35	115	.07	.06	.01	1443.	1.01	22.05	265	.02	.01	.01	335.
1.01	9.40	116	.07	.06	.01	1443.	1.01	22.10	266	.02	.01	.01	335.
1.01	9.45	117	.07	.06	.01	1443.	1.01	22.15	267	.02	.01	.01	335.
1.01	9.50	118	.07	.06	.01	1443.	1.01	22.20	268	.02	.01	.01	335.
1.01	9.55	119	.07	.06	.01	1443.	1.01	22.25	269	.02	.01	.01	335.
1.01	10.00	120	.07	.06	.01	1443.	1.01	22.30	270	.02	.01	.01	335.

1.01	10.05	121	.07	.06	.01	1443.	1.01	22.35	271	.02	.01	.01	335.
1.01	10.10	122	.07	.06	.01	1443.	1.01	22.40	272	.02	.01	.01	335.
1.01	10.15	123	.07	.06	.01	1443.	1.01	22.45	273	.02	.01	.01	335.
1.01	10.20	124	.07	.06	.01	1443.	1.01	22.50	274	.02	.01	.01	335.
1.01	10.25	125	.07	.06	.01	1443.	1.01	22.55	275	.02	.01	.01	335.
1.01	10.30	126	.07	.06	.01	1443.	1.01	23.00	276	.02	.01	.01	335.
1.01	10.35	127	.07	.06	.01	1443.	1.01	23.05	277	.02	.01	.01	335.
1.01	10.40	128	.07	.06	.01	1443.	1.01	23.10	278	.02	.01	.01	335.
1.01	10.45	129	.07	.06	.01	1443.	1.01	23.15	279	.02	.01	.01	335.
1.01	10.50	130	.07	.06	.01	1443.	1.01	23.20	280	.02	.01	.01	335.
1.01	10.55	131	.07	.06	.01	1443.	1.01	23.25	281	.02	.01	.01	335.
1.01	11.00	132	.07	.06	.01	1443.	1.01	23.30	282	.02	.01	.01	335.
1.01	11.05	133	.07	.06	.01	1443.	1.01	23.35	283	.02	.01	.01	335.
1.01	11.10	134	.07	.06	.01	1443.	1.01	23.40	284	.02	.01	.01	335.
1.01	11.15	135	.07	.06	.01	1443.	1.01	23.45	285	.02	.01	.01	335.
1.01	11.20	136	.07	.06	.01	1443.	1.01	23.50	286	.02	.01	.01	335.
1.01	11.25	137	.07	.06	.01	1443.	1.01	23.55	287	.02	.01	.01	335.
1.01	11.30	138	.07	.06	.01	1443.	1.02	0.00	288	.02	.01	.01	335.
1.01	11.35	139	.07	.06	.01	1443.	1.02	.05	289	0.00	0.00	0.00	335.
1.01	11.40	140	.07	.06	.01	1443.	1.02	.10	290	0.00	0.00	0.00	329.
1.01	11.45	141	.07	.06	.01	1443.	1.02	.15	291	0.00	0.00	0.00	304.
1.01	11.50	142	.07	.06	.01	1443.	1.02	.20	292	0.00	0.00	0.00	254.
1.01	11.55	143	.07	.06	.01	1443.	1.02	.25	293	0.00	0.00	0.00	198.
1.01	12.00	144	.07	.06	.01	1443.	1.02	.30	294	0.00	0.00	0.00	139.
1.01	12.05	145	.20	.19	.01	1443.	1.02	.35	295	0.00	0.00	0.00	98.
1.01	12.10	146	.20	.19	.01	1501.	1.02	.40	296	0.00	0.00	0.00	68.
1.01	12.15	147	.20	.19	.01	1739.	1.02	.45	297	0.00	0.00	0.00	48.
1.01	12.20	148	.20	.19	.01	2204.	1.02	.50	298	0.00	0.00	0.00	34.
1.01	12.25	149	.20	.19	.01	2778.	1.02	.55	299	0.00	0.00	0.00	24.
1.01	12.30	150	.20	.19	.01	3297.	1.02	1.00	300	0.00	0.00	0.00	17.
									SUM	30.94	28.79	2.15	688871.
										(786.)(731.)(55.)(19506.68)			

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	26290.	7654.	2392.	2296.	688842.
CMS	744.	217.	68.	65.	19506.
INCHES		23.34	29.18	29.18	29.18
MM		592.93	741.16	741.16	741.16
AC-FT		3745.	4744.	4744.	4744.
THOUS CU M		4681.	5852.	5852.	5852.

HYDROGRAPH AT STA 3 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
0.	0.	0.	0.	0.	2.	13.	35.	65.	85.	
110.	136.	148.	180.	281.	472.	704.	918.	1071.	1183.	
1300.	1319.	1352.	1380.	1399.	1419.	1422.	1429.	1438.	1438.	
1440.	1442.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	
1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	
1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	
1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	
1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	
1443.	1443.	1443.	1443.	1443.	1501.	1739.	2204.	2778.	3297.	

3689.	3963.	4155.	4290.	4382.	4451.	4498.	4550.	4648.	4884.
4986.	5151.	5274.	5368.	5421.	5461.	5489.	5509.	5524.	5560.
5874.	5889.	6151.	6387.	6504.	6690.	6777.	6837.	6879.	6910.
6931.	6896.	6775.	6698.	6914.	7612.	9178.	12636.	18247.	23779.
26290.	25175.	22125.	18775.	15741.	13886.	11335.	9956.	8948.	8228.
7709.	7378.	7142.	6955.	6816.	6672.	6472.	6208.	5926.	5681.
5500.	5372.	5285.	5224.	5183.	5152.	5130.	5028.	4660.	3955.
3086.	2306.	1720.	1382.	1013.	811.	672.	569.	498.	446.
412.	387.	367.	353.	343.	337.	335.	335.	335.	335.
335.	335.	335.	335.	335.	335.	335.	335.	335.	335.
335.	335.	335.	335.	335.	335.	335.	335.	335.	335.
335.	335.	335.	335.	335.	335.	335.	335.	335.	335.
335.	335.	335.	335.	335.	335.	335.	335.	335.	335.
335.	335.	335.	335.	335.	335.	335.	335.	335.	329.
304.	254.	194.	139.	98.	68.	48.	34.	24.	17.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	26290.	7654.	2392.	2296.	688882.
CMS	744.	217.	68.	65.	19506.
INCHES		23.34	29.18	29.18	29.18
MM		592.93	741.16	741.16	741.16
AC-FT		3795.	4744.	4744.	4744.
THOUS CU M		4681.	5852.	5852.	5852.

HYDROGRAPH AT STA 3 FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	6.	18.	33.	48.
60.	68.	74.	90.	141.	236.	352.	457.	535.	591.
630.	657.	676.	690.	700.	706.	711.	714.	717.	719.
720.	721.	721.	721.	721.	721.	721.	721.	721.	721.
721.	721.	721.	721.	721.	721.	721.	721.	721.	721.
721.	721.	721.	721.	721.	721.	721.	721.	721.	721.
721.	721.	721.	721.	721.	721.	721.	721.	721.	721.
721.	721.	721.	721.	721.	721.	721.	721.	721.	721.
721.	721.	721.	721.	721.	750.	869.	1102.	1389.	1648.
1843.	1981.	2077.	2145.	2191.	2225.	2249.	2275.	2322.	2401.
2493.	2576.	2637.	2681.	2710.	2731.	2748.	2755.	2762.	2780.
2837.	2904.	3075.	3193.	3282.	3345.	3388.	3419.	3440.	3455.
3466.	3448.	3388.	3349.	3457.	3806.	4589.	6318.	9124.	11889.
13145.	12587.	11063.	9387.	7870.	6628.	5667.	4978.	4470.	4111.
3855.	3689.	3571.	3477.	3408.	3336.	3236.	3104.	2963.	2840.
2750.	2686.	2643.	2618.	2591.	2576.	2565.	2514.	2330.	1977.
1586.	1198.	860.	691.	907.	406.	336.	285.	249.	223.
204.	193.	183.	176.	171.	169.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	168.	168.	164.
152.	127.	97.	69.	49.	34.	24.	17.	12.	8.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13145.	3827.	1196.	1148.	344421.

PMF HYDROGRAPH ROUTING

NEW MEMPHIS RESERVOIR

```
           CMS      372.      108.      30.      33.          9753.
        INCHES                11.67    14.59    14.59         14.59
            MM               296.40   370.58   370.58        370.58
         AC-FT                1898.    2372.    2372.         2372.
    THOUS CU M                2341.    2926.    2926.         2926.




 *********          *********          *********          *********          *********

                                   HYDROGRAPH ROUTING

            ROUTE HYDROGRAPH THROUGH NEW MEMPHIS RESERVOIR
                       ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                           3       1       0       0       0       0       1       0       0
                                              ROUTING DATA
                  QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
                    0.0   0.000    0.00       1       1       0       0               0

                         NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                             0       0       0   0.000   0.000   0.000   -770.      -1

     STAGE      770.0      771.0      772.0      773.0      774.0      775.5      777.0      779.9      781.3      782.7
                784.1

      FLOW         0.        86.       287.       485.       450.      1317.      2918.      7565.     14036.     28929.
               46747.

   CAPACITY=       0.        20.       301.       999.      2174.      4109.      5164.      7030.     10065.

  ELEVATION=     725.       730.       740.       750.       760.       770.       774.       780.       790.

                       CREL   SPWID    COQW    EXPW   ELEVL    COQL   CAREA    EXPL
                      770.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                               DAM DATA
                                       TOPEL    COQD    EXPD  DAMWID
                                       780.0     0.0     0.0      0.

                               STATION       3, PLAN 1, RATIO 1

                                   END-OF-PERIOD HYDROGRAPH ORDINATES

                                                  OUTFLOW
             0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
             0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
             0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
             0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
             0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
             0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
             0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
             1.         1.         1.         2.         2.         3.         4.         6.         8.        11.
            14.        17.        20.        23.        26.        29.        32.        36.        39.        42.
            45.        48.        52.        55.        58.        61.        64.        67.        71.        74.
            77.        80.        83.        88.        91.        96.       102.       107.       112.       118.
           124.       129.       135.       140.       145.       151.       156.       162.       167.       172.
           177.       183.       188.       193.       198.       203.       208.       214.       219.       224.
           229.       234.       239.       244.       249.       255.       262.       268.       274.       280.
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      286.       292.       298.       303.       309.       315.       322.       331.       342.       356.
      372.       390.       409.       428.       445.       446.       446.       447.       447.       448.
      448.       449.       450.       470.       533.       596.       658.       720.       781.       842.
      903.       966.      1031.      1098.      1167.      1236.      1307.      1429.      1559.      1686.
     1810.      1932.      2049.      2161.      2271.      2390.      2533.      2733.      3090.      3715.
     4459.      5200.      5844.      6353.      6733.      7004.      7188.      7309.      7383.      7424.
     7442.      7445.      7439.      7426.      7408.      7386.      7358.      7324.      7281.      7231.
     7175.      7115.      7054.      6992.      6931.      6870.      6811.      6751.      6685.      6603.
     6496.      6364.      6212.      6049.      5878.      5705.      5532.      5361.      5192.      5028.
     4867.      4712.      4560.      4414.      4272.      4135.      4003.      3875.      3751.      3632.
     3517.      3406.      3299.      3196.      3096.      3000.      2910.      2849.      2789.      2731.
     2674.      2618.      2563.      2510.      2459.      2408.      2359.      2310.      2263.      2217.
     2172.      2129.      2086.      2044.      2003.      1964.      1925.      1887.      1850.      1814.
     1779.      1744.      1711.      1678.      1646.      1615.      1584.      1554.      1525.      1497.
     1469.      1442.      1416.      1390.      1365.      1340.      1317.      1304.      1292.      1279.
     1267.      1254.      1241.      1228.      1213.      1199.      1184.      1170.      1155.      1140.

                                                  STORAGE
     4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.
     4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.
     4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.
     4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.
     4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.
     4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.
     4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4109.      4110.
     4111.      4112.      4113.      4114.      4115.      4118.      4122.      4127.      4134.      4142.
     4150.      4159.      4168.      4177.      4187.      4196.      4206.      4215.      4225.      4235.
     4244.      4254.      4263.      4273.      4282.      4292.      4302.      4311.      4320.      4330.
     4339.      4349.      4358.      4367.      4377.      4386.      4395.      4405.      4414.      4423.
     4432.      4441.      4450.      4459.      4468.      4477.      4486.      4495.      4503.      4512.
     4521.      4530.      4538.      4547.      4555.      4564.      4573.      4581.      4589.      4598.
     4606.      4615.      4623.      4631.      4639.      4648.      4656.      4664.      4672.      4680.
     4688.      4696.      4704.      4712.      4720.      4728.      4736.      4748.      4763.      4781.
     4803.      4826.      4852.      4878.      4905.      4932.      4960.      4988.      5016.      5046.
     5076.      5108.      5141.      5175.      5208.      5242.      5275.      5308.      5341.      5374.
     5406.      5440.      5474.      5510.      5547.      5584.      5622.      5659.      5696.      5733.
     5768.      5803.      5836.      5868.      5900.      5934.      5975.      6032.      6118.      6239.
     6384.      6528.      6652.      6751.      6825.      6878.      6913.      6937.      6951.      6959.
     6963.      6963.      6962.      6959.      6956.      6952.      6946.      6940.      6931.      6922.
     6911.      6899.      6887.      6875.      6863.      6852.      6840.      6828.      6816.      6800.
     6779.      6753.      6724.      6692.      6659.      6625.      6592.      6559.      6526.      6494.
     6463.      6433.      6403.      6375.      6347.      6321.      6295.      6270.      6246.      6223.
     6201.      6179.      6159.      6138.      6119.      6100.      6082.      6065.      6048.      6031.
     6015.      5999.      5983.      5968.      5953.      5939.      5925.      5911.      5898.      5884.
     5872.      5859.      5847.      5835.      5823.      5812.      5801.      5790.      5780.      5769.
     5759.      5749.      5740.      5730.      5721.      5712.      5704.      5695.      5687.      5679.
     5671.      5663.      5656.      5648.      5641.      5634.      5627.      5621.      5614.      5607.
     5601.      5594.      5587.      5580.      5572.      5564.      5556.      5549.      5541.      5533.

                                                    STAGE
     770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0
     770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0
     770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0
     770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0
     770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0
     770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0
     770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.0
     770.0      770.0      770.0      770.0      770.0      770.0      770.0      770.1      770.1      770.1
     770.2      770.2      770.2      770.3      770.3      770.3      770.4      770.4      770.4      770.5
     770.5      770.5      770.6      770.6      770.7      770.7      770.7      770.8      770.8      770.8
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ONE-HALF PMF HYDROGRAPH

NEW MEMPHIS RESERVOIR

770.9	770.9	770.9	771.0	771.0	771.1	771.1	771.1	771.2	771.2
771.2	771.3	771.3	771.3	771.4	771.4	771.4	771.5	771.5	771.5
771.6	771.6	771.6	771.7	771.7	771.7	771.8	771.8	771.8	771.9
771.9	771.9	771.9	772.0	772.0	772.0	772.1	772.1	772.1	772.2
772.2	772.2	772.3	772.3	772.3	772.3	772.4	772.4	772.5	772.5
772.6	772.7	772.8	772.9	773.0	773.1	773.2	773.3	773.4	773.6
773.7	773.8	773.9	774.0	774.1	774.3	774.4	774.5	774.6	774.7
774.8	774.9	775.0	775.1	775.2	775.4	775.5	775.6	775.7	775.8
775.9	776.1	776.2	776.3	776.4	776.5	776.6	776.8	777.1	777.5
777.9	778.4	778.8	779.1	779.3	779.5	779.6	779.7	779.7	779.8
779.8	779.8	779.8	779.8	779.8	779.7	779.7	779.7	779.7	779.7
779.6	779.6	779.5	779.5	779.5	779.4	779.4	779.4	779.3	779.3
779.2	779.1	779.0	778.9	778.8	778.7	778.6	778.5	778.4	778.3
778.2	778.1	778.0	777.9	777.8	777.7	777.6	777.6	777.5	777.4
777.3	777.3	777.2	777.1	777.1	777.0	777.0	776.9	776.8	776.8
776.7	776.7	776.6	776.6	776.5	776.5	776.4	776.4	776.4	776.3
776.3	776.2	776.2	776.2	776.1	776.1	776.0	776.0	776.0	775.9
775.9	775.9	775.9	775.8	775.8	775.8	775.7	775.7	775.7	775.7
775.6	775.6	775.6	775.6	775.5	775.5	775.5	775.5	775.4	775.4
775.4	775.4	775.4	775.3	775.3	775.3	775.3	775.2	775.2	775.2

PEAK OUTFLOW IS 7445. AT TIME 16.83 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7445.	5145.	1675.	1608.	482465.
CMS	211.	146.	47.	46.	13662.
INCHES		15.69	20.44	20.44	20.44
MM		398.61	519.11	519.11	519.11
AC-FT		2551.	3323.	3323.	3323.
THOUS CU M		3147.	4099.	4099.	4099.

STATION 3, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.	1.	1.	2.	3.	4.	6.	7.
8.	10.	11.	13.	15.	16.	18.	19.	21.	23.
24.	26.	27.	29.	31.	32.	34.	35.	37.	38.
40.	42.	43.	45.	46.	48.	49.	51.	52.	54.
55.	57.	59.	60.	62.	63.	65.	66.	68.	69.
71.	72.	74.	75.	77.	78.	80.	81.	82.	84.
85.	87.	89.	91.	94.	96.	99.	102.	104.	107.
109.	112.	114.	117.	119.	122.	126.	130.	136.	143.
150.	156.	160.	174.	183.	191.	200.	209.	217.	227.
236.	244.	258.	271.	284.	296.	309.	321.	334.	347.
360.	376.	388.	403.	418.	433.	445.	445.	446.	446.
447.	447.	447.	448.	448.	449.	449.	480.	608.	701.
910.	1055.	1173.	1268.	1369.	1482.	1574.	1649.	1712.	1768.
1814.	1857.	1897.	1930.	1968.	1999.	2027.	2051.	2072.	

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 2089.     2104.     2117.     2129.     2141.     2151.     2161.     2170.     2176.     2176.
 2166.     2146.     2119.     2087.     2051.     2013..    1974.     1934.     1894.     1855.
 1816.     1777.     1739.     1702.     1666.     1630.     1595.     1561.     1528.     1495.
 1464.     1433.     1403.     1373.     1345.     1317.     1302.     1288.     1273.     1259.
 1245.     1231.     1218.     1204.     1191.     1178.     1165.     1152.     1140.     1127.
 1115.     1103.     1091.     1079.     1067.     1056.     1044.     1033.     1022.     1011.
 1000.      990.      979.      969.      958.      948.      938.      928.      919.      909.
  900.      890.      881.      872.      863.      854.      845.      836.      828.      819.
  811.      802.      794.      784.      775.      766.      756.      747.      737.      728.

                                        STORAGE
 4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.
 4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.
 4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.
 4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.
 4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.
 4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.
 4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.     4109.
 4110.     4110.     4111.     4111.     4112.     4113.     4115.     4118.     4122.     4125.
 4130.     4134.     4138.     4143.     4148.     4153.     4157.     4162.     4167.     4172.
 4177.     4181.     4186.     4191.     4196.     4200.     4205.     4210.     4215.     4219.
 4224.     4229.     4233.     4238.     4243.     4247.     4252.     4257.     4261.     4266.
 4271.     4275.     4280.     4284.     4289.     4293.     4298.     4303.     4307.     4312.
 4316.     4321.     4325.     4329.     4334.     4338.     4343.     4347.     4352.     4356.
 4360.     4365.     4369.     4374.     4378.     4382.     4387.     4391.     4395.     4399.
 4404.     4408.     4412.     4416.     4420.     4425.     4429.     4435.     4443.     4453.
 4464.     4476.     4489.     4502.     4516.     4530.     4544.     4558.     4573.     4587.
 4603.     4619.     4635.     4652.     4668.     4685.     4702.     4719.     4736.     4752.
 4769.     4787.     4805.     4824.     4844.     4864.     4884.     4904.     4925.     4946.
 4966.     4987.     5007.     5027.     5048.     5070.     5095.     5130.     5180.     5249.
 5330.     5413.     5488.     5550.     5601.     5642.     5675.     5701.     5722.     5740.
 5756.     5769.     5782.     5793.     5804.     5813.     5822.     5830.     5837.     5843.
 5848.     5852.     5856.     5859.     5863.     5866.     5868.     5871.     5873.     5873.
 5870.     5864.     5856.     5847.     5837.     5826.     5815.     5804.     5792.     5781.
 5770.     5759.     5748.     5737.     5727.     5717.     5707.     5697.     5688.     5678.
 5669.     5661.     5652.     5643.     5635.     5627.     5619.     5612.     5604.     5596.
 5589.     5582.     5574.     5567.     5560.     5553.     5546.     5539.     5533.     5526.
 5519.     5513.     5506.     5500.     5494.     5488.     5482.     5476.     5470.     5464.
 5458.     5452.     5447.     5441.     5436.     5430.     5425.     5420.     5415.     5409.
 5404.     5399.     5394.     5389.     5385.     5380.     5375.     5371.     5366.     5361.
 5357.     5352.     5348.     5343.     5338.     5333.     5328.     5323.     5318.     5313.

                                         STAGE
 770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0
 770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0
 770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0
 770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0
 770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0
 770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0
 770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0
 770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.0     770.1
 770.1     770.1     770.1     770.1     770.1     770.2     770.2     770.2     770.2     770.2
 770.3     770.3     770.3     770.3     770.3     770.3     770.4     770.4     770.4     770.4
 770.4     770.5     770.5     770.5     770.5     770.5     770.5     770.6     770.6     770.6
 770.6     770.6     770.6     770.7     770.7     770.7     770.7     770.7     770.8     770.8
 770.8     770.8     770.8     770.8     770.9     770.9     770.9     770.9     770.9     770.9
 771.0     771.0     771.0     771.0     771.0     771.0     771.1     771.1     771.1     771.1
 771.1     771.1     771.1     771.2     771.2     771.2     771.2     771.2     771.3     771.3
 771.3     771.4     771.4     771.5     771.5     771.6     771.6     771.7     771.8     771.8
 771.9     771.9     772.0     772.1     772.1     772.2     772.2     772.3     772.4     772.4
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INFLOW PMF AND ONE-HALF PMF

OLD MEMPHIS RESERVOIR

(Local Flows)

772.5	772.6	772.6	772.7	772.8	772.9	772.9	773.0	773.1	773.2
773.3	773.3	773.4	773.5	773.6	773.6	773.7	773.9	774.1	774.3
774.5	774.8	775.0	775.2	775.4	775.5	775.6	775.7	775.8	775.9
775.9	775.9	776.0	776.0	776.1	776.1	776.1	776.1	776.2	776.2
776.2	776.2	776.2	776.2	776.2	776.3	776.3	776.3	776.3	776.3
776.3	776.3	776.2	776.2	776.2	776.1	776.1	776.1	776.0	776.0
775.9	775.9	775.9	775.8	775.8	775.8	775.7	775.7	775.7	775.7
775.6	775.6	775.6	775.5	775.5	775.5	775.5	775.4	775.4	775.4
775.4	775.3	775.3	775.3	775.3	775.3	775.2	775.2	775.2	775.2
775.1	775.1	775.1	775.1	775.1	775.0	775.0	775.0	775.0	775.0
774.9	774.9	774.9	774.9	774.9	774.9	774.8	774.8	774.8	774.8
774.8	774.8	774.7	774.7	774.7	774.7	774.7	774.7	774.6	774.6
774.6	774.6	774.6	774.6	774.6	774.5	774.5	774.5	774.5	774.5

PEAK OUTFLOW IS 2176. AT TIME 18.25 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2176.	1646.	589.	565.	169595.
CMS	62.	47.	17.	16.	4802.
INCHES		5.02	7.18	7.18	7.18
MM		127.53	182.48	182.48	182.48
AC-FT		816.	1168.	1168.	1168.
THOUS CU M		1007.	1441.	1441.	1441.

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SUB-AREA RUNOFF COMPUTATION

INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SCS UNIT

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
18	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	-1	1.48	0.00	1.48	1.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.80	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	.85	.07	0.00	0.00

GIVEN UNIT GRAPH, NUMGO= 31

0.	15.	170.	470.	1050.	1420.	1592.	1492.	1360.	950.
730.	560.	450.	360.	206.	188.	140.	112.	80.	60.
42.	34.	30.	20.	17.	14.	11.	8.	5.	2.
0.									

UNIT GRAPH TOTALS 11566. CFS OR 1.01 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

MO,DA	HR,MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1,01	,05	1	,01	0,00	,01	0,
1,01	,10	2	,01	0,00	,01	0,
1,01	,15	3	,01	0,00	,01	0,
1,01	,20	4	,01	0,00	,01	0,
1,01	,25	5	,01	0,00	,01	0,
1,01	,30	6	,01	0,00	,01	0,
1,01	,35	7	,01	0,00	,01	0,
1,01	,40	8	,01	0,00	,01	0,
1,01	,45	9	,01	0,00	,01	0,
1,01	,50	10	,01	0,00	,01	0,
1,01	,55	11	,01	0,00	,01	0,
1,01	1,00	12	,01	0,00	,01	0,
1,01	1,05	13	,01	0,00	,01	0,
1,01	1,10	14	,01	0,00	,01	0,
1,01	1,15	15	,01	0,00	,01	0,
1,01	1,20	16	,01	0,00	,01	0,
1,01	1,25	17	,01	0,00	,01	0,
1,01	1,30	18	,01	0,00	,01	0,
1,01	1,35	19	,01	0,00	,01	0,
1,01	1,40	20	,01	0,00	,01	0,
1,01	1,45	21	,01	0,00	,01	0,
1,01	1,50	22	,01	0,00	,01	0,
1,01	1,55	23	,01	0,00	,01	0,
1,01	2,00	24	,01	0,00	,01	0,
1,01	2,05	25	,01	0,00	,01	0,
1,01	2,10	26	,01	0,00	,01	0,
1,01	2,15	27	,01	0,00	,01	0,
1,01	2,20	28	,01	0,00	,01	0,
1,01	2,25	29	,01	0,00	,01	0,
1,01	2,30	30	,01	0,00	,01	0,
1,01	2,35	31	,01	0,00	,01	0,
1,01	2,40	32	,01	0,00	,01	0,
1,01	2,45	33	,01	0,00	,01	0,
1,01	2,50	34	,01	0,00	,01	0,
1,01	2,55	35	,01	0,00	,01	0,
1,01	3,00	36	,01	0,00	,01	0,
1,01	3,05	37	,01	0,00	,01	0,
1,01	3,10	38	,01	0,00	,01	0,
1,01	3,15	39	,01	0,00	,01	0,
1,01	3,20	40	,01	0,00	,01	0,
1,01	3,25	41	,01	0,00	,01	0,
1,01	3,30	42	,01	0,00	,01	0,
1,01	3,35	43	,01	0,00	,01	0,
1,01	3,40	44	,01	0,00	,01	0,
1,01	3,45	45	,01	0,00	,01	0,
1,01	3,50	46	,01	0,00	,01	0,
1,01	3,55	47	,01	0,00	,01	0,
1,01	4,00	48	,01	0,00	,01	0,
1,01	4,05	49	,01	0,00	,01	0,
1,01	4,10	50	,01	0,00	,01	0,
1,01	4,15	51	,01	0,00	,01	0,
1,01	4,20	52	,01	0,00	,01	0,
1,01	4,25	53	,01	0,00	,01	0,
1,01	4,30	54	,01	0,00	,01	0,
1,01	4,35	55	,01	0,00	,01	0,
1,01	4,40	56	,01	0,00	,01	0,
1,01	4,45	57	,01	0,00	,01	0,
1,01	4,50	58	,01	0,00	,01	0,

MO,DA	HR,MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1,01	12,35	151	,80	,19	,01	1321,
1,01	12,40	152	,20	,19	,01	1518,
1,01	12,45	153	,20	,19	,01	1698,
1,01	12,50	154	,20	,19	,01	1824,
1,01	12,55	155	,20	,19	,01	1920,
1,01	13,00	156	,20	,19	,01	1996,
1,01	13,05	157	,24	,23	,01	2051,
1,01	13,10	158	,24	,23	,01	2099,
1,01	13,15	159	,24	,23	,01	2133,
1,01	13,20	160	,24	,23	,01	2177,
1,01	13,25	161	,24	,23	,01	2237,
1,01	13,30	162	,24	,23	,01	2308,
1,01	13,35	163	,24	,23	,01	2382,
1,01	13,40	164	,24	,23	,01	2449,
1,01	13,45	165	,24	,23	,01	2508,
1,01	13,50	166	,24	,23	,01	2551,
1,01	13,55	167	,24	,23	,01	2584,
1,01	14,00	168	,24	,23	,01	2608,
1,01	14,05	169	,30	,29	,01	2628,
1,01	14,10	170	,30	,29	,01	2645,
1,01	14,15	171	,30	,29	,01	2664,
1,01	14,20	172	,30	,29	,01	2701,
1,01	14,25	173	,30	,29	,01	2770,
1,01	14,30	174	,30	,29	,01	2859,
1,01	14,35	175	,30	,29	,01	2957,
1,01	14,40	176	,30	,29	,01	3048,
1,01	14,45	177	,30	,29	,01	3130,
1,01	14,50	178	,30	,29	,01	3188,
1,01	14,55	179	,30	,29	,01	3233,
1,01	15,00	180	,30	,29	,01	3267,
1,01	15,05	181	,18	,18	,01	3293,
1,01	15,10	182	,36	,36	,01	3314,
1,01	15,15	183	,36	,36	,01	3309,
1,01	15,20	184	,54	,54	,01	3297,
1,01	15,25	185	,63	,63	,01	3270,
1,01	15,30	186	1,54	1,53	,01	3338,
1,01	15,35	187	2,53	2,53	,01	3523,
1,01	15,40	188	,99	,99	,01	4042,
1,01	15,45	189	,63	,63	,01	5079,
1,01	15,50	190	,54	,54	,01	6783,
1,01	15,55	191	,36	,36	,01	8829,
1,01	16,00	192	,36	,36	,01	10327,
1,01	16,05	193	,28	,27	,01	10971,
1,01	16,10	194	,28	,27	,01	10797,
1,01	16,15	195	,28	,27	,01	10016,
1,01	16,20	196	,28	,27	,01	8699,
1,01	16,25	197	,28	,27	,01	7586,
1,01	16,30	198	,28	,27	,01	6639,
1,01	16,35	199	,28	,27	,01	5862,
1,01	16,40	200	,28	,27	,01	5229,
1,01	16,45	201	,28	,27	,01	4636,
1,01	16,50	202	,28	,27	,01	4311,
1,01	16,55	203	,28	,27	,01	4037,
1,01	17,00	204	,28	,27	,01	3823,
1,01	17,05	205	,22	,21	,01	3695,
1,01	17,10	206	,22	,21	,01	3522,
1,01	17,15	207	,22	,21	,01	3410,
1,01	17,20	208	,22	,21	,01	3327,

1.01	4.55	59	.01	0.00	.01	0.	1.01	17.25	209	.22	.21	.01	3218.
1.01	5.00	60	.01	0.00	.01	0.	1.01	17.30	210	.22	.21	.01	3090.
1.01	5.05	61	.01	0.00	.01	0.	1.01	17.35	211	.22	.21	.01	2989.
1.01	5.10	62	.01	0.00	.01	0.	1.01	17.40	212	.22	.21	.01	2859.
1.01	5.15	63	.01	0.00	.01	0.	1.01	17.45	213	.22	.21	.01	2758.
1.01	5.20	64	.01	0.00	.01	0.	1.01	17.50	214	.22	.21	.01	2684.
1.01	5.25	65	.01	.01	.01	0.	1.01	17.55	215	.22	.21	.01	2625.
1.01	5.30	66	.01	.01	.01	0.	1.01	18.00	216	.22	.21	.01	2577.
1.01	5.35	67	.01	.01	.01	1.	1.01	18.05	217	.02	.01	.01	2543.
1.01	5.40	68	.01	.01	.01	4.	1.01	18.10	218	.02	.01	.01	2515.
1.01	5.45	69	.01	.01	.01	10.	1.01	18.15	219	.02	.01	.01	2467.
1.01	5.50	70	.01	.01	.01	20.	1.01	18.20	220	.02	.01	.01	2361.
1.01	5.55	71	.01	.01	.01	31.	1.01	18.25	221	.02	.01	.01	2144.
1.01	6.00	72	.01	.01	.01	43.	1.01	18.30	222	.02	.01	.01	1856.
1.01	6.05	73	.07	.06	.01	53.	1.01	18.35	223	.02	.01	.01	1535.
1.01	6.10	74	.07	.06	.01	62.	1.01	18.40	224	.02	.01	.01	1236.
1.01	6.15	75	.07	.06	.01	77.	1.01	18.45	225	.02	.01	.01	963.
1.01	6.20	76	.07	.06	.01	106.	1.01	18.50	226	.02	.01	.01	773.
1.01	6.25	77	.07	.06	.01	165.	1.01	18.55	227	.02	.01	.01	626.
1.01	6.30	78	.07	.06	.01	243.	1.01	19.00	228	.02	.01	.01	514.
1.01	6.35	79	.07	.06	.01	329.	1.01	19.05	229	.02	.01	.01	428.
1.01	6.40	80	.07	.06	.01	409.	1.01	19.10	230	.02	.01	.01	356.
1.01	6.45	81	.07	.06	.01	482.	1.01	19.15	231	.02	.01	.01	314.
1.01	6.50	82	.07	.06	.01	533.	1.01	19.20	232	.02	.01	.01	276.
1.01	6.55	83	.07	.06	.01	573.	1.01	19.25	233	.02	.01	.01	248.
1.01	7.00	84	.07	.06	.01	603.	1.01	19.30	234	.02	.01	.01	226.
1.01	7.05	85	.07	.06	.01	626.	1.01	19.35	235	.02	.01	.01	210.
1.01	7.10	86	.07	.06	.01	645.	1.01	19.40	236	.02	.01	.01	198.
1.01	7.15	87	.07	.06	.01	656.	1.01	19.45	237	.02	.01	.01	190.
1.01	7.20	88	.07	.06	.01	666.	1.01	19.50	238	.02	.01	.01	183.
1.01	7.25	89	.07	.06	.01	674.	1.01	19.55	239	.02	.01	.01	177.
1.01	7.30	90	.07	.06	.01	680.	1.01	20.00	240	.02	.01	.01	173.
1.01	7.35	91	.07	.06	.01	684.	1.01	20.05	241	.02	.01	.01	170.
1.01	7.40	92	.07	.06	.01	688.	1.01	20.10	242	.02	.01	.01	167.
1.01	7.45	93	.07	.06	.01	690.	1.01	20.15	243	.02	.01	.01	165.
1.01	7.50	94	.07	.06	.01	692.	1.01	20.20	244	.02	.01	.01	163.
1.01	7.55	95	.07	.06	.01	693.	1.01	20.25	245	.02	.01	.01	162.
1.01	8.00	96	.07	.06	.01	694.	1.01	20.30	246	.02	.01	.01	162.
1.01	8.05	97	.07	.06	.01	695.	1.01	20.35	247	.02	.01	.01	162.
1.01	8.10	98	.07	.06	.01	696.	1.01	20.40	248	.02	.01	.01	162.
1.01	8.15	99	.07	.06	.01	696.	1.01	20.45	249	.02	.01	.01	162.
1.01	8.20	100	.07	.06	.01	697.	1.01	20.50	250	.02	.01	.01	162.
1.01	8.25	101	.07	.06	.01	697.	1.01	20.55	251	.02	.01	.01	162.
1.01	8.30	102	.07	.06	.01	697.	1.01	21.00	252	.02	.01	.01	162.
1.01	8.35	103	.07	.06	.01	697.	1.01	21.05	253	.02	.01	.01	162.
1.01	8.40	104	.07	.06	.01	697.	1.01	21.10	254	.02	.01	.01	162.
1.01	8.45	105	.07	.06	.01	697.	1.01	21.15	255	.02	.01	.01	162.
1.01	8.50	106	.07	.06	.01	697.	1.01	21.20	256	.02	.01	.01	162.
1.01	8.55	107	.07	.06	.01	697.	1.01	21.25	257	.02	.01	.01	162.
1.01	9.00	108	.07	.06	.01	697.	1.01	21.30	258	.02	.01	.01	162.
1.01	9.05	109	.07	.06	.01	697.	1.01	21.35	259	.02	.01	.01	162.
1.01	9.10	110	.07	.06	.01	697.	1.01	21.40	260	.02	.01	.01	162.
1.01	9.15	111	.07	.06	.01	697.	1.01	21.45	261	.02	.01	.01	162.
1.01	9.20	112	.07	.06	.01	697.	1.01	21.50	262	.02	.01	.01	162.
1.01	9.25	113	.07	.06	.01	697.	1.01	21.55	263	.02	.01	.01	162.
1.01	9.30	114	.07	.06	.01	697.	1.01	22.00	264	.02	.01	.01	162.
1.01	9.35	115	.07	.06	.01	697.	1.01	22.05	265	.02	.01	.01	162.
1.01	9.40	116	.07	.06	.01	697.	1.01	22.10	266	.02	.01	.01	162.
1.01	9.45	117	.07	.06	.01	697.	1.01	22.15	267	.02	.01	.01	162.
1.01	9.50	118	.07	.06	.01	697.	1.01	22.20	268	.02	.01	.01	162.

1.01	9.55	119	.07	.06	.01	697.	1.01	22.25	269	.02	.01	.01	162.
1.01	10.00	120	.07	.06	.01	697.	1.01	22.30	270	.02	.01	.01	162.
1.01	10.05	121	.07	.06	.01	697.	1.01	22.35	271	.02	.01	.01	162.
1.01	10.10	122	.07	.06	.01	697.	1.01	22.40	272	.02	.01	.01	162.
1.01	10.15	123	.07	.06	.01	697.	1.01	22.45	273	.02	.01	.01	162.
1.01	10.20	124	.07	.06	.01	697.	1.01	22.50	274	.02	.01	.01	162.
1.01	10.25	125	.07	.06	.01	697.	1.01	22.55	275	.02	.01	.01	162.
1.01	10.30	126	.07	.06	.01	697.	1.01	23.00	276	.02	.01	.01	162.
1.01	10.35	127	.07	.06	.01	697.	1.01	23.05	277	.02	.01	.01	162.
1.01	10.40	128	.07	.06	.01	697.	1.01	23.10	278	.02	.01	.01	162.
1.01	10.45	129	.07	.06	.01	697.	1.01	23.15	279	.02	.01	.01	162.
1.01	10.50	130	.07	.06	.01	697.	1.01	23.20	280	.02	.01	.01	162.
1.01	10.55	131	.07	.06	.01	697.	1.01	23.25	281	.02	.01	.01	162.
1.01	11.00	132	.07	.06	.01	697.	1.01	23.30	282	.02	.01	.01	162.
1.01	11.05	133	.07	.06	.01	697.	1.01	23.35	283	.02	.01	.01	162.
1.01	11.10	134	.07	.06	.01	697.	1.01	23.40	284	.02	.01	.01	162.
1.01	11.15	135	.07	.06	.01	697.	1.01	23.45	285	.02	.01	.01	162.
1.01	11.20	136	.07	.06	.01	697.	1.01	23.50	286	.02	.01	.01	162.
1.01	11.25	137	.07	.06	.01	697.	1.01	23.55	287	.02	.01	.01	162.
1.01	11.30	138	.07	.06	.01	697.	1.02	0.00	288	.02	.01	.01	162.
1.01	11.35	139	.07	.06	.01	697.	1.02	.05	289	0.00	0.00	0.00	162.
1.01	11.40	140	.07	.06	.01	697.	1.02	.10	290	0.00	0.00	0.00	162.
1.01	11.45	141	.07	.06	.01	697.	1.02	.15	291	0.00	0.00	0.00	159.
1.01	11.50	142	.07	.06	.01	697.	1.02	.20	292	0.00	0.00	0.00	153.
1.01	11.55	143	.07	.06	.01	697.	1.02	.25	293	0.00	0.00	0.00	138.
1.01	12.00	144	.07	.06	.01	697.	1.02	.30	294	0.00	0.00	0.00	118.
1.01	12.05	145	.20	.19	.01	697.	1.02	.35	295	0.00	0.00	0.00	96.
1.01	12.10	146	.20	.19	.01	699.	1.02	.40	296	0.00	0.00	0.00	75.
1.01	12.15	147	.20	.19	.01	722.	1.02	.45	297	0.00	0.00	0.00	56.
1.01	12.20	148	.20	.19	.01	784.	1.02	.50	298	0.00	0.00	0.00	43.
1.01	12.25	149	.20	.19	.01	923.	1.02	.55	299	0.00	0.00	0.00	32.
1.01	12.30	150	.20	.19	.01	1110.	1.02	1.00	300	0.00	0.00	0.00	25.
									SUM	30.94	28.79	2.15	332895.
										(786.)(731.)(55.)(9426.54)			

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10971.	3683.	1156.	1110.	332898.
CMS	311.	104.	33.	31.	9427.
INCHES		23.15	29.06	29.06	29.06
MM		587.92	738.15	738.15	738.15
AC-FT		1826.	2293.	2293.	2293.
THOUS CU M		2252.	2828.	2828.	2828.

HYDROGRAPH AT STA 18 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	4.	10.	20.
31.	43.	53.	62.	77.	106.	165.	243.	329.	409.
482.	533.	573.	603.	626.	645.	656.	666.	674.	680.
684.	688.	690.	692.	693.	694.	695.	696.	696.	697.
697.	697.	697.	697.	697.	697.	697.	697.	697.	697.
697.	697.	697.	697.	697.	697.	697.	697.	697.	697.
697.	697.	697.	697.	697.	697.	697.	697.	697.	697.

697.	697.	697.	697.	697.	697.	697.	697.	697.	697.
697.	697.	697.	697.	697.	699.	722.	784.	923.	1110.
1321.	1518.	1698.	1824.	1920.	1994.	2051.	2099.	2133.	2177.
2237.	2304.	2362.	2449.	2508.	2551.	2584.	2608.	2628.	2645.
2664.	2701.	2770.	2859.	2957.	3048.	3130.	3186.	3233.	3267.
3293.	3314.	3309.	3297.	3270.	3334.	3523.	4042.	5079.	6783.
8629.	10327.	10971.	10797.	10016.	8695.	7586.	6635.	5862.	5229.
4636.	4311.	4037.	3823.	3655.	3522.	3418.	3327.	3218.	3090.
2969.	2859.	2758.	2684.	2625.	2577.	2543.	2515.	2467.	2361.
2144.	1856.	1535.	1236.	963.	773.	626.	514.	428.	356.
314.	276.	248.	226.	210.	198.	190.	183.	177.	173.
170.	167.	165.	163.	162.	162.	162.	162.	162.	162.
162.	162.	162.	162.	162.	162.	162.	162.	162.	162.
162.	162.	162.	162.	162.	162.	162.	162.	162.	162.
162.	162.	162.	162.	162.	162.	162.	162.	162.	162.
162.	162.	162.	162.	162.	162.	162.	162.	162.	162.
159.	153.	138.	118.	96.	75.	56.	43.	32.	25.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10971.	3683.	1156.	1110.	332898.
CMS	311.	104.	33.	31.	9427.
INCHES		23.15	29.06	29.06	29.06
MM		587.92	738.15	738.15	738.15
AC-FT		1826.	2293.	2293.	2293.
THOUS CU M		2252.	2828.	2828.	2828.

HYDROGRAPH AT STA 1R FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	2.	5.	10.
16.	21.	27.	31.	36.	53.	82.	121.	164.	205.
241.	267.	286.	301.	313.	323.	328.	333.	337.	340.
342.	344.	345.	346.	347.	347.	348.	348.	348.	348.
349.	349.	349.	349.	349.	349.	349.	349.	349.	349.
349.	349.	349.	349.	349.	349.	349.	349.	349.	349.
349.	349.	349.	349.	349.	349.	349.	349.	349.	349.
349.	349.	349.	349.	349.	349.	349.	349.	349.	349.
349.	349.	349.	349.	349.	350.	361.	392.	461.	555.
660.	759.	849.	912.	960.	997.	1026.	1050.	1067.	1080.
1110.	1134.	1191.	1224.	1254.	1275.	1292.	1304.	1314.	1322.
1332.	1350.	1385.	1429.	1478.	1524.	1565.	1594.	1616.	1634.
1647.	1657.	1655.	1648.	1635.	1667.	1768.	2021.	2539.	3391.
4414.	5164.	5486.	5399.	5008.	4347.	3793.	3318.	2931.	2614.
2318.	2156.	2019.	1912.	1828.	1761.	1709.	1663.	1609.	1545.
1469.	1429.	1379.	1342.	1312.	1289.	1271.	1257.	1233.	1181.
1072.	928.	768.	618.	482.	387.	313.	257.	214.	178.
157.	138.	124.	113.	105.	99.	95.	92.	89.	87.
85.	84.	82.	82.	81.	81.	81.	81.	81.	81.
81.	81.	81.	81.	81.	81.	81.	81.	81.	81.
81.	81.	81.	81.	81.	81.	81.	81.	81.	81.
81.	81.	81.	81.	81.	81.	81.	81.	81.	81.
81.	81.	81.	81.	81.	81.	81.	81.	81.	81.
80.	76.	69.	59.	48.	38.	28.	21.	16.	12.

COMBINED UPSTREAM ROUTED HYDROGRAPHS

WITH DOWNSTREAM LOCAL HYDROGRAPHS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5886.	1841.	578.	555.	166449.
CMS	155.	52.	16.	16.	4713.
INCHES		11.57	14.53	14.53	14.53
MM		293.96	369.07	369.07	369.07
AC-FT		913.	1146.	1146.	1146.
THOUS CU M		1126.	1414.	1414.	1414.

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COMBINE HYDROGRAPHS

COMBINE UPSTREAM ROUTED HYDROGRAPH WITH DOWNSTREAM HYDROGR

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
18	2	0	0	0	0	1	0	0

SUM OF 2 HYDROGRAPHS AT 18 PLAN 1 RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	4.	11.	20.
32.	44.	54.	63.	79.	109.	169.	249.	337.	420.
496.	550.	592.	626.	652.	674.	689.	702.	713.	722.
729.	736.	741.	746.	751.	755.	759.	763.	767.	771.
774.	777.	780.	784.	788.	793.	799.	804.	810.	816.
821.	826.	832.	837.	843.	848.	853.	859.	864.	869.
875.	880.	885.	890.	895.	901.	906.	911.	916.	921.
926.	931.	936.	941.	947.	953.	959.	965.	971.	977.
983.	989.	995.	1001.	1007.	1015.	1044.	1114.	1264.	1466.
1693.	1908.	2107.	2252.	2365.	2440.	2497.	2546.	2580.	2625.
2685.	2757.	2831.	2919.	3041.	3146.	3242.	3328.	3409.	3487.
3568.	3667.	3800.	3957.	4123.	4284.	4437.	4617.	4791.	4983.
5104.	5246.	5358.	5457.	5542.	5724.	6057.	6775.	8169.	10498.
13287.	15528.	16815.	17150.	16789.	15698.	14774.	13944.	13245.	12653.
12078.	11797.	11477.	11244.	11063.	10907.	10776.	10651.	10499.	10322.
10144.	9973.	9812.	9677.	9555.	9448.	9354.	9266.	9152.	8964.
8640.	8220.	7746.	7284.	6841.	6478.	6158.	5875.	5620.	5383.
5181.	4988.	4809.	4640.	4482.	4333.	4193.	4058.	3929.	3805.
3687.	3573.	3464.	3359.	3258.	3162.	3072.	3011.	2951.	2893.
2836.	2780.	2725.	2672.	2620.	2570.	2520.	2472.	2425.	2379.
2334.	2291.	2248.	2206.	2165.	2126.	2087.	2049.	2012.	1976.
1941.	1906.	1873.	1840.	1808.	1777.	1746.	1716.	1687.	1659.
1631.	1604.	1578.	1552.	1527.	1502.	1479.	1456.	1434.	1411.
1426.	1407.	1379.	1346.	1309.	1274.	1240.	1212.	1187.	1165.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	17150.	8083.	2831.	2718.	819384.
CMS	486.	229.	80.	77.	23089.
INCHES		16.60	23.25	23.25	23.25
MM		421.60	590.67	590.67	590.67
AC-FT		4008.	5615.	5615.	5615.
THOUS CU M		4948.	6927.	6927.	6927.

AD-A104 828 PRC CONSOER TOWNSEND INC ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. MEMPHIS RESERVOIR DAM (MO 10163) M--ETC(U)
JAN 79 DACW43-78-C-0160
UNCLASSIFIED NL

END
DATE FILMED
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SUM OF 2 HYDROGRAPHS AT 18 PLAN 1 RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	2.	5.	10.
16.	22.	27.	32.	39.	54.	85.	125.	169.	210.
248.	275.	296.	313.	326.	337.	344.	351.	356.	361.
369.	368.	371.	373.	376.	378.	380.	382.	384.	385.
387.	389.	390.	392.	393.	395.	396.	398.	400.	401.
403.	404.	406.	407.	409.	410.	412.	413.	415.	416.
418.	419.	421.	422.	424.	425.	427.	428.	430.	431.
433.	434.	435.	437.	440.	442.	445.	448.	450.	453.
455.	458.	460.	463.	465.	469.	483.	518.	592.	691.
803.	909.	1007.	1078.	1134.	1180.	1217.	1250.	1275.	1306.
1345.	1390.	1437.	1483.	1525.	1559.	1588.	1613.	1635.	1656.
1679.	1710.	1758.	1817.	1881.	1941.	1998.	2039.	2062.	2079.
2093.	2103.	2102.	2096.	2083.	2115.	2210.	2470.	3019.	4000.
5175.	6079.	6541.	6571.	6276.	5716.	5275.	4892.	4580.	4326.
4084.	3970.	3876.	3809.	3761.	3729.	3708.	3691.	3660.	3617.
3573.	3533.	3496.	3471.	3453.	3440.	3433.	3427.	3409.	3356.
3238.	3074.	2887.	2704.	2532.	2399.	2287.	2191.	2108.	2032.
1973.	1915.	1863.	1815.	1771.	1729.	1690.	1653.	1617.	1582.
1549.	1517.	1485.	1455.	1426.	1398.	1383.	1369.	1354.	1340.
1326.	1312.	1299.	1285.	1272.	1259.	1246.	1233.	1220.	1208.
1196.	1184.	1172.	1160.	1148.	1137.	1125.	1114.	1103.	1092.
1081.	1071.	1060.	1050.	1039.	1029.	1019.	1009.	1000.	990.
981.	971.	962.	953.	944.	935.	926.	917.	909.	900.
891.	879.	863.	844.	823.	803.	784.	768.	754.	740.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6571.	3022.	1167.	1120.	336044.
CMS	186.	86.	33.	32.	9516.
INCHES		6.20	9.58	9.58	9.58
MM		157.60	243.44	243.44	243.44
AC-FT		1498.	2314.	2314.	2314.
THOUS CU M		1848.	2855.	2855.	2855.

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HYDROGRAPH ROUTING

ROUTE COMBINED HYDROGRAPH THROUGH OLD MEMPHIS RESERVOIR A

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
18	1	0	0	2	0	1	0	0

ROUTING DATA

GLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT

SUMMARY OF PMF AND ONE-HALF PMF FLOOD ROUTING

AND

DAM SAFETY ANALYSIS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	 RATIO 2 .50
HYDROGRAPH AT	3	3.05 (7.90)	1	26290. (744.44)	13145. (372.22)
ROUTED TO	3	3.05 (7.90)	1	7445. (210.83)	2178. (61.62)
HYDROGRAPH AT	18	1.48 (3.83)	1	10971. (310.67)	5486. (155.34)
2 COMBINED	18	4.53 (11.73)	1	17150. (485.64)	6571. (186.08)
ROUTED TO	18	4.53 (11.73)	1	15356. (434.89)	4515. (127.84)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	770.00	770.00	780.00
STORAGE	4109.	4109.	7030.
OUTFLOW	0.	0.	8299.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	779.79	0.00	6963.	7445.	0.00	16.83	0.00
.50	776.28	0.00	5873.	2176.	0.00	18.25	0.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	716.20	716.20	720.20
STORAGE	235.	235.	421.
OUTFLOW	0.	0.	2381.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	724.13	3.93	812.	15358.	9.00	16.33	0.00
.90	721.83	1.23	544.	4515.	3.83	16.58	0.00


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